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HAS SCIENCE DISCOVERED GOD?

Books by Edward H. Cotton

THE IDEALS OF THEODORE ROOSEVELT

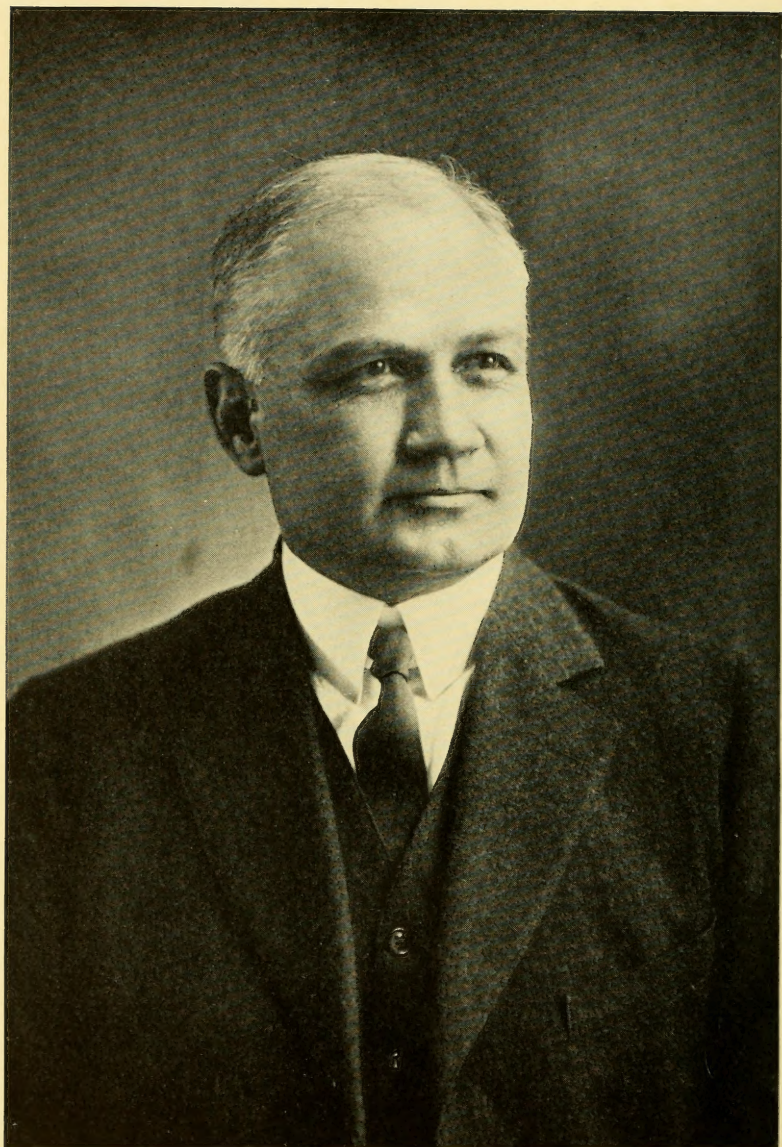
THEODORE ROOSEVELT THE AMERICAN

THE LIFE OF CHARLES W. ELIOT

CHARLES W. ELIOT'S TALKS TO PARENTS
AND YOUNG PEOPLE (Editor)

WILLIAM HOWARD TAFT: A CHARACTER STUDY

HAS SCIENCE DISCOVERED GOD? (Editor)



Edward H. Catton

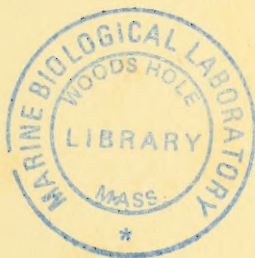
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HAS SCIENCE DISCOVERED GOD?

A SYMPOSIUM OF MODERN
SCIENTIFIC OPINION

Gathered and Edited by
EDWARD H. COTTON

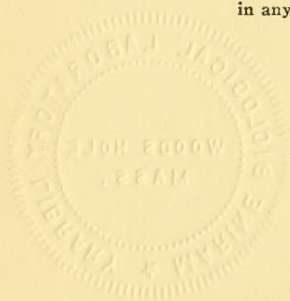


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*To our children,
who teach us more of
Eternal Goodness
than all the sages*

"The religion that fears science,
insults God and commits suicide."

RALPH WALDO EMERSON.

PREFACE

NINE of the essays that follow have been written especially for this book. The authors are: Kirtley F. Mather, professor of Geology, Harvard University; Heber D. Curtis, director of the Detroit Observatory of the University of Michigan; Edwin G. Conklin, professor of Zoology, Princeton University; George Thomas White Patrick, professor of Philosophy, the University of Iowa; William McDougall, professor of Psychology, Duke University; Sir J. Arthur Thomson, author of "The Outline of Science," etc.; Harlan T. Stetson, director of the Perkins Observatory, Ohio Wesleyan University; Sir Oliver Lodge, author of "Why I Believe in Personal Immortality," etc.; and Dr. J. Malcolm Bird, formerly research officer for the American Society for Psychical Research and author of "Einstein's Theories of Relativity and Gravitation."

The other seven chapters have been selected from available sources and made to conform to the theme of the volume. In each instance credit has been given.

The contributors were asked to write with entire freedom, seeking only to serve truth and human good; and appreciation is here expressed for their work, much of which was done in the midst of pressing responsibilities, and in the interests of a greater cause.

Also thanks are due to Dr. Thomas H. Billings and Dr. Arthur D. Little for critical examination of my

introduction. Dr. Billings is a clergyman and Dr. Little is a manufacturing chemist. In this manner the survey of both religion and science was secured.

E. H. C.

*Marblehead, Mass.,
September 1, 1931.*

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“The materialistic position that there is nothing in the world but matter, force and necessity, is as utterly devoid of justification as the most baseless of theological dogmas.”

THOMAS H. HUXLEY.

INTRODUCTION

WE are entering one of the most significant periods in the records of the human race, so far as man's attempt to explain himself and his relation to the universe is concerned. This is said, mindful of historic evolutions, revolutions and reformations.

The thought, perhaps oftenest in our mind, is that about the meaning of life for us, personally, and the meaning of the universe that envelops us. It may be a narrow path that leads from the breakfast table to the office and home again. Calls to household tasks come day in, day out. The necessity for carrying on the occupation, pleasant or unpleasant, through the years in order to support the family may find us dispirited and rebellious at times. But always, on the elevations and in the depressions of experience, we are thinking, thinking—why we are here, and what we are here to do.

Human beings are not flitting about like the moth in a glare of light, without sense of direction. They have definite sense of direction. This whole fabric of education, industry, business, families, states, international combinations, is built up on the assumption that life has purpose and meaning. Just what that purpose and meaning may be we are puzzled to know. But to conclude that it is not present constantly and everywhere is to make life a trifling episode on the one hand, or a grim punishment on the other. But life

is neither trifling nor a punishment for most of us; it is an experience filled with promise, with delights, with great expectations.

But we do desire, often with yearning unspeakable, to explain the mysteries; to be assured that all the beauties philosophy has described, all the rewards religion has promised, are actual, and not plausible theories only. Religion actually proves nothing; neither does philosophy—in the sense in which men require proof to-day. Philosophy investigates and interprets. Religion professes and has faith. But neither gives to reason convictions which can withstand the attacks of doubt and despair when the “lights are low and all the wheels of being slow.”

We need to say in justice to the philosopher that he is “the spectator of all time and of all existence,” to use Plato’s interpretation. He must hold his conclusions in abeyance. He must keep himself outside the whirl of events, yet he must constantly be aware of them. Philosophy’s relation to science is to interpret the facts it discovers, often fragmentary. Religion then takes this interpretation and idealizes it, glorifies it perhaps. Science, in this connection, constantly checks religious impulse. Religion, with equal right, may warm up science.

We are not for a moment removing philosophy and religion from their rightful places. They have given to experience, and will continue to give, riches of knowledge and hope. We simply say they have not, with all their striving, explained the enigma of creation—the eternal paradox of whence, why, and whither. Perhaps this is not a justified indictment.

It is not in the estimation of those who say that the creative genius is unknowable. But is it unknowable? Chapter by chapter the book of knowledge of the eternal meaning of things unfolds. As rapidly as the human race can assimilate new facts they are impinged on some human brain. Philosophy will help in this ultimate solution; so will religion. But their function, probably, is not that of discovering Cosmic Reality; but of conserving the best in experience, to reassure, to visit the widow and the fatherless in their affliction, noble enough callings.

Leaders of religion, of course, will question this position. They will ask: Is not the great and final function of religion discovery and interpretation of Cosmic Reality? Perhaps so. Yet religion has not found that Reality, much less interpreted it, in the estimation of many thoughtful and devout men, particularly when the terms Cosmic Reality and God are thought of synonymously, as they usually are in common thinking. We are not so disturbed over the fact that traditional religion interprets the God-Reality with some hundreds of different definitions, as we are that not one of them *proves* much of anything to thoughtful, honest seekers. These seekers admire the devotion and self-denial of the devout religionist. They may envy him his assurance, and the consolation his convictions afford him in times of distress; but his attempted demonstration that God exists does not convince them. Why? Because, for the most part, religion has been seeking and describing a God of three dimensions, a being to conform to its earthly notions of time, space and measurement. In speaking of

heaven these descriptions only outline an exalted earth.

The unlettered negroes of the far southern part of the United States have implicit belief that Jehovah, the hero of the Old Testament, is directly concerned in their welfare. This conviction carries them joyfully through many labors and tribulations. Now the Jehovah of the Old Testament is not to be dismissed with a gesture of indifference, by any means. From Genesis on through to Hosea he is a magnificent figure, perhaps as magnificent a figure of deity as has ever been described in the sacred books of nations. And certainly the thought of deity as directly concerned for a favorite people's welfare, seeking to make them worthwhile men and women, trying all sorts of experiments: the gift of Paradise, the terrible punishment of all but extermination, direction to the Promised Land, once more the discipline for wilfulness in a sad captivity; and then learning at last that only vicarious suffering will save the race, is one of the noblest stories ever told. And surely nothing that has ever happened in this world has set the human race further along its way than the sublime self-denials of Jesus.

All this has pointed the road. Jesus was a spiritual genius, best exemplar of an eternal, merciful Reality. If there is any proof of God in religion it is in Jesus and in other heroic souls who have lived in imitation of him. It is certainly not in theologies, creeds and spectacular declarations, as an infallible Bible, a decree-in-council, or a pronouncement ex-cathedra.

We have had pantheism, deism, theism, agnosticism, humanism, and other labelled schools of religious thinking: one declaring God has been found and his

nature described; another that he cannot be found, hence cannot be described; another that he is an intimate experience; another that he is as far away as the most distant nebula. But it rather seems as if these would-be prophets and dialecticians came out by the same door through which they went in. And whichever way the final verdict stood, the humble seeker after truth and light did not find his doubts dissolved nor his troubles lessened. High-powered discussions as to whether God exists or does not exist do not help average men and women much.

And how has it been with immortality? The attempt to demonstrate immortality has exhibited precisely the same irresolute, unconvincing methods. A religion without convictions of immortality is hardly a religion. Yet religion has no proofs that man survives the breaking up of this physical structure. Leaders of religion whose chief duty is to assure those who have loved and lost, of personal survival, have no definite argument to present. Again and again their consolation goes no further than to ask the bereaved to be resigned, to believe that all is well, that God is good. Once more, if religion tries to explain immortality, which, of course, it does, it uses terms which fit an immortality of three dimensions: with a Valhalla, a Paradise, a Dante's imaginative portrayal, a St. John's vision of repose and reward.

There have been, and are still, high and noble souls within the sacred precincts, who, when they go up to the temple go up to pray; and the remembrance of them is blessed. A religious idea carried through with earnestness and sincerity, though reason rebels at it, commands our admiration. One of the most astonishing

instances in the development of the western part of the United States was the migrations of the Mormons under the autocratic, shrewd leadership of Brigham Young, from Missouri to the valley of the Great Salt Lake. Those people represented a religion which was founded on pure fallacy on the one hand and colossal egotism on the other. Yet it commanded the devotion of thousands of men and women through religious persecutions surpassing any ever inflicted in this country. It sent the contingent over a thousand miles of unknown desert and mountain; persuaded them to settle in a region so salt and arid that only one scrubby tree grew there; and induced them to accept an institution, that of plural marriage, so repugnant to the natures of many of them who were of New England Puritan extraction, that they declared they would rather have died than conform. If there is any influence in this world which can exceed that of a religious idea, true or false, which has become a conviction in the human mind, it has not been our fortune to have chanced upon it. Salt Lake City and the development of Utah is proof.

What we wish to prove is this, however. Religion has been trying these centuries of time to demonstrate the reality of God; and to assign him place and measurement. It has been trying with equal diligence and methods to prove that man is immortal. It has failed in both instances. Religion certainly has not failed to implant convictions in response to which men have joyfully confronted physical torments. It has not failed to provide consolation and reassurance for multitudes of saddened people. An honest practice and

profession of religious faith is the finest act in which humankind can engage. In the name of religion some of the most sublime deeds have been enacted and lives lived. We would not be lacking for a moment in proper recognition of all this; and a reverence for the faith in whose name it was done. But we cannot see that we are much nearer finding God as Cosmic Reality through the help of religion, or of proving immortality, than we were back in the time of the first dim dawning in the primitive Neanderthal mind that there might be such a reality; and that something might happen to a man's spirit when, after bravely fighting, he was killed by his enemy.

Some are about to conclude now that we are going to say that this remarkable swing of science away from the materialistic and metallic interpretation of the universe, held generally by science up to the beginning of this century, to an idealistic and spiritual interpretation of experience, means that science is going to do what religion and philosophy have failed to do, namely, find God, and assure us that we live on in other spheres of activity. But we are not going to say that at all. In the first place there is no man of science we know who would for a moment assume that responsibility, one which religion has blithely assumed for some centuries; and in the second place most men of research do not think it is in their province to capture and define ultimate reality.

As to investigation into personal survival, the other element of universal human interest which religion has always considered within its particular jurisdiction, another attitude needs to be taken, and is taken in the two papers in this symposium on that subject. Psychic

research is a distinctly scientific activity. We may add that no endeavor in the field of science has displayed a higher courage. If personal survival has been, or is to be proved, psychic research will be the method.

The genius of science is to find a fact—whether it be the positive and negative activities of an electron, the marvellous utilities of carbon, or the composition of the planet Jupiter. But, inasmuch as science must of necessity include an exploration of the phenomena of the universe, multitudinous in variety, it, necessarily, in every one of its explorations, is searching for ultimate reality. How can it help it? Science is the great truth-seeking adventure. Devoted men of science do not conclude that the effort is ill-spent when the energies of a lifetime are dedicated to the discovery of a germ responsible for a particular disease; or to the measurement of light waves or sound waves; or to the discovery and charting of a star galaxy. Everywhere are these men toiling quietly to discover and prove a fact. So we hear of the devoted young research worker who knew his organic chemistry so well that he saved his firm \$150,000 in three years. His salary was \$3,000 a year, which the firm did not increase; and the young man did not ask it.

And then there is the instance of Dr. Albert A. Michelson whose earthly investigations ceased as this symposium was being prepared; and who was invited to contribute to it but could not, owing to rapidly failing health. Dr. Michelson was within a few hours of death, and aware of its approach, when he completed his final experiment, and dictated its results. For half a century he had studied light, its source, gradations, velocity, and so on. This last experiment

involved correction of a possible error in the speed of light—perhaps a mile in 186,000 miles a second. Science, also, hath its consecrated followers.

The results of the labors of research-men are before us in a multitude of practical everyday applications. It is probably true that we could not have had a science without a religion; but it is true, also, that we could not have had an applied religion as we know it to-day without a science. No one doubts that the vast expanses of the universe, disclosed by giant telescopes, exist. No one doubts the miracles performed by radio activity. No one doubts the marvels of plant and animal life revealed by long, patient explorations in the field of biology. In other words when science announces a discovery the average man accepts the discovery, because the method of the scientist is not to announce the fact until it has been proved. Science has been mistaken, and will be again. But the point is this, its method of procedure is sound and begets confidence, and its motive is honest and often self-effacing.

We have said that science disclaims the intention of searching for God. In reality science cannot help searching for God in every minutest action it makes, because it is a search for reality; and a search for reality always is a search for God. So we have the paradox of investigators engaging with skill, diligence, often self-denial, in a search they are hardly aware they are engaging in; and which, strangely enough, yet not so strangely either, in the last two or three years, has brought them square up against the precise problem with which religion and philosophy so long have been struggling.

So we see leading scientists centering their efforts on a solution of the puzzle of the ages: the creative force back of phenomena, and the destiny of man's spirit.

Alexander Pope said once, "The undevout astronomer is mad." He might have extended his discerning comment to the fields of mathematics, biology, physics, chemistry, psychology and psychics. No man, familiar daily with the astonishing demonstration of unity, purpose, activities, combinations of the wonders of creation, as men working in these fields must be, could fail to be profoundly reverent before the majesty and glory of it all. Men engaged in research, from Copernicus and Newton through Darwin, Spencer and Huxley, and on to our own day, have been men of deep religious feeling. They were distinctly non-conformists. But that did not mean they lacked the profound religious urge. We might put it this way: they worked in the *spirit* of science.

In every epoch of the evolution of scientific thought, orthodox religion has been left rather far in the rear. This fact is as true to-day as it was when the Inquisition compelled Galileo, at the age of seventy, after he had made the richest contribution to progress of any man of his time, to recite an incantation. In addition he was sentenced to prison, and obliged to repeat, by way of penance, the seven penitential psalms daily for three years. Yet the ecclesiastical council which sentenced him and silenced him, triumphant enough in its own day, in ours has been mercilessly exposed and ridiculed; while Galileo is thought of as the really religious

force of his time. Nor are we to forget that history is constantly repeating itself.

It probably is true, as John Langdon-Davies declares again and again in his remarkable book, *Man and His Universe*, that the entire endeavor of research from the beginning until now has been to find God. But not until the present time has science left its traditional seclusion, come out into the open, and declared—or at all events not denied—that its true objective is the Eternal Reality, creating and sustaining, in this mysterious universe. Consciously or unconsciously, research has set itself to prove that the universe is more than a fortuitous concourse of atoms—it *has a soul*. All of which gives aid and comfort to the average man that the beauties of life have not been lost, as he may have feared, and that as an individual he may have eternal expectations.

The early Hebrews were satisfied with a deity who would conduct them to a land flowing with milk and honey, help them conquer it, and provide them with commandments, laws, sacrifices and rituals. Then Jesus came, speaking not like the Scribes and Pharisees who were immersed in the Mosaic tradition. He taught that the law, the sacrifice and the ritual were not the most important. God is a spirit, a soul. He desires spiritual service. In consequence the dialecticians who spent their days in the temple debating what the Mosaic law meant as touching disposal of the meat left from the burnt-offerings, rose in their wrath and might. Jesus had spoken rebellious words. He must be silenced or he would overturn the established order of things. In reality the ecclesiastics of

his day feared what ecclesiastics of all times have feared—that their philosophy of life, built up with extreme care and system, would be found wanting.

But Jesus was right. The trouble has been that traditional religion has been on the side of the Inquisition and the Synagogue. But that was not the worst of it: the worst of it was, that it thought, at the same time, that it was on the side of the angels. Undoubtedly the corporation of the Pharisees believed they were doing Jehovah loyal service when they persuaded Pilate to crucify the outcast. Undoubtedly the inquisitors believed society was being well served when they silenced Galileo because his assertion that the earth had diurnal rotation was “absurd in philosophy, and erroneous as to faith.” We have no sect of Pharisees or Holy Office to-day which could exert similar pressure. But somehow the methods and deductions of established religion do not inspire confidence; and a cry of despair is heard in the land, the quality of which no observing mind will mistake.

The question, then, before us is—and it is exceeded in importance by no question of our time—Can science find God? And, equally important, can it prove to us that we survive the event of death? If science succeeds in doing this, despite its reluctance to assume the responsibility, it will confer on mankind the greatest benefit it ever has conferred; and, in reality, only be following out the convictions of two of its greatest exponents, Thomas Huxley and Louis Pasteur. Said Huxley: “Science inculcates veracity of thought and action, without which there can be no alleviation to the suffering of mankind.” And Pasteur closely follows him: “The cultivation of science in its highest

expression is perhaps more necessary to the moral condition than to the material prosperity of a nation."

Opinions included in this book have been gathered for the purpose of proving to everyday men and women that men of research are beginning to find evidence of God and of continuance of active life in spheres beyond that of earth.

If God is found research will find Him, and not traditional religion. But here we must not be misunderstood. We are entirely reverent, and appreciative of the great services of religion to suffering, groping humanity. These papers are not invectives against religion; they would point the way to a religion of more expansive, nobler proportions. Neither do we wish to remove science from its legitimate sphere. But we are inclined to think that the sooner religion in the orthodox and traditional sense surrenders the quest for Cosmic Reality, and concentrates on serving men in their personal needs, the better for religion and the better for humanity. Religion has been given a considerable chance. But has it found any but a nebulous, uncertain, unsatisfactory God? Religion has measured deity with the rods of dogma, pronouncements of councils, sectarian confessions, which, in turn, have been determined by political expediency, tradition, and a knowledge limited to locality and time.

No rigorous religionist ever dreams of finding God by the laboratory method; the thought savors too much of irreverence: but does it savor of irreverence? Is there any real logical objection to searching for God through the scientific method? In fact, are not other methods repugnant to reason? After all, science at

its best is an expression of poetry, art, harmony; elements intimately associated with the God Idea.

Science has developed the spectroscope, microscope, telescope and a score of other observing, measuring, tabulating instruments. It has discovered, measured and analyzed the nearest and minutest forms of life, and the most distant and colossal. In this way it has vastly extended and expanded, beyond anything religion has ever known, the elements, achievement and character of the Supreme Architect. Between the Deity of organized religion and that of research, in this particular, a gulf wide and deep is fixed; which, of course is one reason why science and religion perpetually misunderstand each other. Behind the electron with its wonder-challenging, incessant activity, and the giant star-cluster recently discovered at the Mount Wilson Observatory which is moving away from the earth at the rate of 7,200 miles a second, may be an Infinite control—science is not denying it. This control, traditional religion with its restricted methods, never can find. Until it broadens its horizon considerably it never can comprehend the light, the glory and the majesty of this tremendous Cosmic Force. According to the best in religion God is a creating, sustaining activity. Between this hypothesis and the hypothesis of contemporary science there is no conflict. But between the method and the practice there is a wide difference, which makes cooperation difficult.

Probably the conceptions of God in the minds of men of research, and those in the minds of sectarians are as far apart as the antipodes; so that when the two talk of Eternal Reality, and of religion also, they

mean entirely different values. Science can understand how the professor of a certain religious belief devotes himself to playing the Good Samaritan, and can admire him for it, for it knows well enough that the only way real moral progress is made is by application of that parable. But it cannot understand a God measured in three dimensions; and confined in rituals and denominational statements. John Tyndall was right: science has no protest to make against religion as a search for God, he said, it only protests when that search expends its energies in the manufacture of "Mythological scenery."

Leaders of religion nobly resisted the trend of science to make the universe a machine controlled by a set of mechanical laws. And this idea of the universe as a mechanism set going in some mysterious fashion began to lose ground early in the present century. Research workers began to suspect there might be back of phenomena more than the dust of which its material was composed, and the ninety-two elements of matter into which it had been resolved. Some of them began to see the universe as a mathematical design. But there can be no mathematical design without a designer. This idea steadily gained strength, until today, research, as we have attempted to explain, is, in reality, a search for God, and for eternal life.

We have had occasion to criticize the methods of religious leaders. As a matter of fact religion remains the supreme concern of mankind, the hope of mankind, and the inspiration of mankind. Its steps, at times, may have faltered; but even in its faltering it prepared the way for the men of research; and no

honest research-worker fails to understand it that way, or fails to acknowledge his debt.

Religion, then, is the parent of research. The prodigal has caused the father much doubt and anxiety. But who can tell—the son may return at last. At no time in the history of the two movements were they nearer converging than the present. Religion can never become a science, not even a glorified science. But science may become a religion, and seems on the verge of doing so. Here is an opportunity for interpreters of the universe and man's place in it, an opportunity, perhaps, without precedent. Life for every man is going to be tremendously benefited by this new understanding on the part of science of its relation to the religious life of the community. And religion, protest though it does, is seeing its possibilities wonderfully increased. Science needs the fervor, the faith, the human-heartedness religion has to give. And religion needs the method, the vision, the discoveries of science. Between them they should and will give us an Eternal Reality glorious beyond imagining; and a life here and hereafter joyous and filled with deep meaning.

Present-day research sees design in the universe. This is one of the most significant contributions; because, as we have already pointed out, if there is design there must be an entity of some sort making the design. Always among us will be mystical spirits who will see an infinite and beneficent purpose continually at work. The fact must not escape our attention that we have at present possibly the most able and devoted group of men engaging in the work of research of any epoch in the evolution of science. Certainly at no

time have men of science made such free confessions of faith. God reveals Himself in mysterious ways. What right have we to say that metaphysics does not operate, under specific conditions, in the affairs of men? On this hypothesis revelation, in truth, is not sealed. There must be a Power outside ourselves which works for righteousness. Is that Power going to reveal itself, again, through the vast, marvellously ordered cosmos disclosed by modern science?

Not long ago Einstein announced his religious faith, an exceedingly simple confession for the exponent of the theory of relativity; which inclines us to think that this investigator, who has set on foot the greatest revolution in human thinking since Darwin, may be, after all, a simple soul. He merely said that "the cosmic religious experience is the strongest and noblest driving force behind scientific research"; that "it is enough for me to contemplate the mystery of conscious life perpetuating itself through all eternity, to reflect upon the marvellous structure of the universe which we can daily perceive, to try humbly to comprehend even an infinitesimal part of the intelligence manifested in nature." But it was when he declared that, "the only deeply religious people of our largely materialistic age are the earnest men of research," that he stirred up the animals. Leaders of organized religion moved uneasily on their thrones. And certain established faiths bitterly attacked him as heretic and infidel. However, liberal thinkers generally saw merit in his position.

In reality what does this gentle soul, though profound mind, believe? He denies out of hand that sci-

ence has any wish to supplant religion. But at the same time he declares, "all the finer speculations in the realm of science spring from a deep religious feeling; and without such feeling they would not be fruitful." He perceives clearly enough other religious activities besides those of scientific investigation. But he does believe that the true man of research must employ the highest spiritual faculties. At one with religion, he says, are feelings of beauty, ethical ideals, self-denying labors for mankind. "Modern science is tending toward the highest achievements—a sort of transcendental synthesis." He likens modern scientific conceptions of the universe to a great painting, or a great piece of music, inspiring high and noble thoughts such as always have been characteristic of religion. Science today, he goes on, seeks to exalt mankind; to satisfy a striving for release, and exaltation of spirit he has always sought. Far from wishing to move in a realm distant from that of common men Einstein has always had a passion for human welfare: "The ideals which have always shone before me are goodness, beauty and truth."

No term unless it is evolution has caused more interest and discussion than relativity. Relativity, in the sense of investigation of cosmic phenomena, is not a theory for the average mind to play with. However, as evolution had its implications in the life of everyday men and women, so does relativity, for there is a relativity of conduct as much as there is a relativity of the cosmos; and as soon as it is understood is likely to exert as much influence. Relativity, applied to time, space and measurement has caused as much upheaval and overturning as any theory ever advanced by a man

of science. It will exert a similar influence when applied to individual activities, because human nature is one of the most important manifestations, at least for us, of the Universal-All.

John Langdon-Davies gives an excellent demonstration of this in the case of the criminal. Social traditions assign the law-breaker to a place in the court of the Gentiles, if, indeed, he gets as near as that to the conformists. He must be deprived of liberty—"to live, and yet not to live." Relativity comes along, now, a strong ally of psychiatry, and says that the criminal was simply unfortunate in his heredity and environment. He could not have acted otherwise. Society has to be protected, of course; but society has an equal, intelligent obligation to treat him with consideration, for his conduct was contingent on, and relative to, his environment. Investigate environment first, and punish afterward.

Dr. Millikan believes that "science undoubtedly is influencing and changing religion quite profoundly now." He calls the idea of making the world better, "as divine an event as has ever taken place; and due directly to science." He has no desire to penetrate the realm beyond that of intellectual knowledge, leaving investigation there to religion. He sees only two points of view with regard to the whole quest of religion: that of the dogmatist; and that of the truth-seeker. Organized religion and churches, he says, must keep pace with investigation, otherwise they will give place to some other form of organization more in keeping with the trend of events. Dr. Millikan is convinced religion will endure as long as man himself. He

makes this positive statement: "A capricious and omnipotent God has been replaced by a deity who rules by law and who is more dependable than the God of other days." The scientific method has caused a "stupendous" change of attitude toward the supernatural. He calls science the "mainspring" of this age; and predicts a steadily increasing interest in investigation. He sees behind the universe, behind all cosmic manifestation, "A creator continually on the job." And this assurance, to him, gives evidence that the universe will never run itself down. Dr. Millikan has written freely of his religious convictions; but one of the most significant things he ever said related to the elimination from scientific thinking of a universe composed only of material substances. His positive assertion that "now the atom is an amazingly complicated *organism*, exhibiting many functions and properties, quite as mysterious as those that used to masquerade under the name of mind," closed forever the door on a purely mechanistic universe. God he defines as "The unifying principle in the universe," the idea including "the amazing new scientific developments in the fields of ether physics, relativity, and wave mechanics."

Professor Eddington, whose book, *The Nature of the Physical World*, published in 1928, ventured to introduce a sort of idealism into research, encouraged several men of science who were thinking in similar terms. A dozen or more volumes followed, placing the scientific hope close beside that of idealistic religion, and preparing the way, perhaps, for what may prove one of the major changes in the scientific-religious relationship.

Eddington doubts that "Men are only a bit of star

gone wrong." He believes we demand "Something more than consciousness." Modern science has no place for materialism and determinism. Life is more than atoms and other cosmic marvels. We have human hearts which cry: "What is it all about?" "It means a great deal to me," he says, "to conceive of God as Him through whom comes power and guidance." Yet Professor Eddington cannot entertain an idea of God which will not stand "close examination." Neither is he particularly interested in a physics which "Pursues to the bitter end the attempt to reach purely objective reality." Then he adds reverently, "Let science pause before rushing in to apply a supposed scientific test; for such a test would go too far, stripping away from our lives not only our religion but all our feelings which do not belong to the function of a measuring machine. . . . Life is a spirit in which truth has its shrine, with potentialities of self-fulfilment in its response to beauty and light."

Julian Huxley does not hesitate to say that modern science is going to mean a new religion. He adds that even liberal theologians have failed to comprehend adequately the point at issue, namely, that the scientific method deals not only with matter but with human nature in all its phases. Religion as he understands it has nothing whatever to do with an absolute, an unknowable God. The idea of an independent God is losing its hold on human thinking. People want a new religion, he declares. They want one which will conform to modern scientific knowledge; and which will completely satisfy individual need; and in that religion there need not be an entity absolute and omnipotent.

Sir Oliver Lodge, perhaps the world's leading au-

thority so far as demonstrating personal survival through scientific proof is concerned, makes careful distinction between matter and spirit. Spirit is the highest development we can conceive, he says, and exists in and out of the body—out of it more readily and completely than in it. It is only because we think so continuously in terms of physical being that we cannot form mental concepts of the reality of spirit. Minds disciplined to think in terms of spirit reality do not doubt that development of personality outside the body is far more important than development in it. In the paper contributed to this discussion he makes it clear that the process which meant an end of the bodily organism had no effect on the soul entity save to release it for further life. In proof of this he asks for experience rather than argument.

We have cited, in brief, the beliefs of these men as examples of the trend of research so far as it relates to idealism, and ventures on the metaphysical. Remarkable as it may seem, it would be difficult to find an authority in any department of science to-day who is not interested in metaphysics: they are vitally interested because they know the close relationship which prevails between research and human welfare, expressed on this human plane and on higher planes of existence also. These discerning men know full well that no quest in which men can engage can, for a moment, equal in interest the search for God through His universe. To say the same thing in slightly different language: several leading scientists—those we have mentioned, and those we have not mentioned, but whose opinions are included in this symposium—have

discovered that the true and ultimate objective of mankind is solution of the metaphysical riddle. Not only are they intrigued and fascinated by the puzzle; they are genuinely and devotedly interested to solve it for the higher interests of mankind. And what they have revealed to us: what they are going to reveal to us, is filled with meaning for men and women all the way up and down the scale of place and privilege. Science has ceased to be a subject for the selected and gifted, if, indeed, it ever was, and has come to have practical application for practical men. And, as we read the signs of the times, it is going to point the way to a religion which can be proved and applied.

Spectroscopes, telescopes, microscopes, laboratories, expeditions conducted for research, are only means—the end is discovery of the First Cause, the Value of Values. And now we can but repeat that science is not, as religion, directly engaged in this quest. Despite itself, however, its method, its instruments, its equipment of trained men, its dedication to acceptance of fact and fact only, its further and further reach into the mysteries and marvels of electrons and star-clusters and test-tube analyses, make it inevitable that, if a First Cause is found, research will find it sooner than an energy based on pronouncements in council, ecclesiastical establishments—sooner even than faith, trust and hope, sublime as these values certainly are.

We have suspected what the trouble with religion has been, all along; but now relativity has demonstrated it: its efforts have been confined *inside the time process*. God is inside the time process; but he is also outside it. And to find the God outside the time process, organized religion has no equipment other than

its faith. This happens to be but one of many implications of Relativity, indicating the contribution the theory has to make in the search for God.

This striking attempt of investigators in the realm of science to make phenomena discovered in observatories and laboratories fit in with idealism and the quest for Infinite Control, in no way detracts from the work and hope of the churches. A few lines above we said "... organized religion has no equipment other than its faith." This is not denying, by any means, the power of faith in personal lives. One of the most inspiring and useful influences of our times is the consecration of the churches: ministry and laity. They give hope for despair, trust for suspicion, confidence for doubt; and men of science are the first to acknowledge it. Religion remains with them, the primary concern of mankind.

What are the "Master Lights of all our seeing:" alike to men of religion and men of science? They are, and will remain, Beauty, Hope and Love. We know no higher, finer values. But for most of us laymen the very acme of these supreme values lies hidden outside this three-dimensional world, this isolated sphere of clocks, yardsticks, algæ and oxides.

What is man that thou art mindful of him;
Or the son of man that thou visitest him?

Research is not, then, an isolated effort. It extends beyond human experience, and beyond this relatively minor earth. But in another sense, and one of much more interest to us, personally, research busies itself. Men engaging in it are not separated in any degree from their fellowmen in ideals of goodness, truth and

"mutual aid." We are toiling together, all of us, in the interests of the Greater Good: a union of all who love in the service of all who suffer. The radiance never has been lost: it simply has not been found for many of us. To find it is the quest of science and religion, and of philosophy also. And the papers which follow have this object in mind. They were not written to entertain, and entertain only. But each of them, read thoughtfully, will do more for readers than fiction, however thrilling, can ever do, for they delve deep into the riches of living truth.

Scientific investigation is earnest. Prophets of gloom are not wanting who speak and write as those without hope, faith or joy: sometimes it seems almost without intelligence. Mr. Mencken speaks sadly of those scientists who still keep their reverence and respect for religion. He includes in that list, of course, not only about all the leading scientific men of the present, but Sir Isaac Newton, Faraday, Clerk-Maxwell, Agassiz, Pasteur, research-workers whose awe and reverence before cosmic law and order were never questioned. The fact is rather significant that while God is disappearing among certain glib, jaunty writers with the naturalistic tinge, he is reappearing in the scientific mind a far more convincing, majestic reality than ever in the history of human thinking.

With the coming of hope and revelation on the part of twentieth century science, we are witnessing the passing of life viewed as an experience of cynicism, despair and tragedy, outlined, cleverly enough, in a certain recent literature. Much modern literature, and art also, is unreal. It is not familiar with current events and conclusions, nor with human nature, either.

Its chief need is application of the scientific test. Probably a journalism which delights in probing every act of mankind and finding it not good, will always be with us. But, "thanks to the human heart by which we live . . . the meanest flower that blows can give thoughts that do often lie too deep for tears." Men of research, of all men everywhere, know the everlasting truth of Wordsworth's great ode; and, patiently, rescue us from the critics. At the close of the darkest day we look to them to paint the fading landscape with the radiance of setting suns.

So we are entering a time of great expectations; and once more are "in the morning of the world."

Now may we really tell you why we have gathered the statements which compose this book? Assuredly we have not gathered them solely for the purpose of collecting in one volume the conclusions of representative scientists on the relation of science and religion. We would be doing an injustice to the men who have written, and to those who have allowed their work to be used, if we did not offer a further explanation. We wish to present the summarized conclusions of research to-day concerning the inner spiritual experience, the search for Reality and the life everlasting, for contemplation by those men and women whose belief in the God-Reality, and in themselves, perchance, may have suffered shock in the recent cynical, naturalistic upheaval, and world-wide economic depression; and for other men and women whose philosophy of life may yet be in process of formation.

Those looking for statements of finality and of absolute values will be disappointed, because such con-

clusions are not the business of mathematics, chemistry, astronomy, physics and psychics. But persons who honestly are seeking those values of Goodness, Truth and Beauty, which, after all, may be the best expression of God, and of ourselves, also, will not fail in their quest.

The men of research who have contributed directly to this cooperative effort have, without exception, given their best. They were selected through the process of elimination. The opinions they have contributed are the results of protracted study, represent balanced judgment, and indicate striking appreciation of the significance of the metaphysical trend of present-day science. Taken as a whole their contributions point the way clearly and emphatically to imminent and inevitable changes in the approach to the idea of God and of immortality.

The bearing of science on religion, for centuries, has vitally affected human thinking and action, never more so than to-day when, if we may coin a phrase, science has become metaphysically-conscious. Any one interested in religion either in its cosmic aspect or its effect on character development who fails to familiarize himself with opinions, such, for instance, as those presented in this symposium, is missing one of the most significant tendencies in present-day thinking, so far as day-by-day living is affected. For example, J. Malcolm Bird, in the truly remarkable study which concludes this discussion, predicts in no uncertain voice that science and religion must meet eventually at a cross-roads designated by the phenomena of psychical research, spiritistic and non-spiritistic. If he is right, and if other writers in this group who present equally

progressive opinions are right, men who think in terms of social regeneration on higher planes confront a reformation of formidable proportions, perhaps as formidable as any we have known.

Everywhere are protests against materialism. Religion is being liberalized. Philosophy is being humanized. Science is being spiritualized. In truth the very stars in their courses seem to be conspiring together to submerge physical desire and to release spiritual aspiration. Are we, at last, really climbing the Mount of Transfiguration? And shall we meet there the figures of men redeemed and glorified? The universe has groaned and travailed together until this present time. Is the long-hidden reason for existence about to be disclosed? Perhaps, yet, we must wait awhile. But, at least, we may wait that revelation with a great hope and joy.

Edward H. Cotton.

SERMONS FROM STONES

KIRTLEY F. MATHER

KIRTLEY FLETCHER MATHER, through his researches in geological and geographical science, lectures, radio broadcasts, articles and books is known in Europe and America as a leading scientist. He is member of a number of learned societies. He was geologist for Richmond Levering and Company which sent an exploring expedition into Eastern Bolivia, 1919-1920. At present he is chairman of the department of Geology and Geography, Harvard University. He is also a geologist of the United States Geological Survey and has made field studies for that organization in Alaska and the United States. Professor Mather's grandfather, Rev. A. E. Mather, was one of the leading Baptist ministers in the Middle West a generation ago. His parents became earnest adherents of that church, providing a deeply religious atmosphere for their son. "There is such a thing as revelation," he says, "and we are in the midst of it all the time." No one, to-day, writing and speaking on scientific subjects as they are related to religion, is read and listened to more eagerly than Dr. Mather. His book, *Science in Search of God*, is widely read, particularly among students. We may say in conclusion that he was the first person we consulted in regard to this symposium, and has steadily supported it.



I

SERMONS FROM STONES

By KIRTLEY F. MATHER

WHEN it is recalled that geology involves not only the study of minerals and rocks but also the entire history of the earth and its inhabitants, it becomes apparent why the geologist may have something to say which is of interest and importance to the theologian. The appeal to history has always been pre-eminent in the literature and oratory of religion, from the days of the Prophet Micah onward to the present time. But whereas the prophets of Israel had a mental background provided by only a few centuries of the history of one small Semitic tribe and its neighbors, the citizen of this modern scientific world has at his disposal the gorgeous panorama of the myriad kinds of animals and plants evolving through hundreds of millions of years of geologic time.

To the man of science every event in the history of the universe is a miracle. It is both awe-inspiring and significant, a "sign and wonder." The more we know about the world, the more mysterious and marvelous it becomes. The arrogance which characterized so many scientists of preceding generations has given place to a true humility, admirably displayed by most of the leaders in contemporary scientific progress. The expanding horizon of knowledge has simply lengthened

the line of contact between man and the unknown elements in the cosmos. Knowledge and mystery have always had a habit of appearing hand in hand, and to-day we are beginning to suspect that the mind of man is incapable of grappling with ultimate reality in any truly scientific way. There may be in the cosmos that which can actually be termed the Absolute, but all we know is Relative. We are in the midst of a process of change, of transformation of matter and energy, a process which reveals no suggestion of any real beginning, no prospect of any truly final end. Perhaps that process is, after all, Reality itself.

The better the events in that process are understood, the more significant they are. For each event is a means of insight into the nature of the motive powers operating in and through the world in which we live. The administration of the universe is revealed by what it has accomplished in the past and by its present activities. In other words, the characteristics of reality are to be discovered by observing behavior. Behavior is the clue to any adequate understanding of the transformations of matter and of energy. It is the behavior of human beings which gives us knowledge concerning the nature of men. It is the behavior of cosmic forces which provides an insight into the real characteristics and qualities of the motive power of the universe.

The results of the long-continued action and interaction of cosmic forces are in part recorded in the rocks of the earth's crust. The tattered and frayed pages of Mother Earth's diary cover a period of well on toward two billion years. The major events in that long history are now fairly well known. From them

we may deduce certain very definite inferences concerning the forces which produced them.

This approach to truth is of course the method which science always attempts to use. It is the habit of mind which is responsible for whatever success has been gained by those in scientific pursuits. Most people nowadays like the spirit of science and approve its tactics. The method of appeal to facts and experiences rings true; its authority may not be absolute, but it is sufficient. Certainly, with great accord the citizens of the modern scientific world are accepting as their final court of appeal, not the assertions of prophets or scholars, but the very facts and experiences themselves. No scientific argument is settled to-day by an appeal to Aristotle, Darwin or Einstein; no theological discussion is terminated by a citation from the Bible, the Koran or the Book of Mormon.

Words are symbols; facts and experiences alone are real. An authority based upon them is of course not infallible, but it is the best we have. Human fallibility, necessarily inherent in every intellectual process, is involved in each appeal to them. The conclusion of the scientist is inevitably based upon descriptions of facts; the fact may be real, but its description may be either true or false. The revelation of the theologian is merely the interpretation of experiences; the experience may be real, but its interpretation may be either right or wrong. Knowledge and wisdom are filtered through human brains before they can issue in action, in sentiments or in ideas. It is an unescapable limitation upon us all.

With the widespread recognition of that limitation,

the thoughtful man of to-day turns to those who have been practicing the method of science for suggestions concerning a satisfactory basis for religious aspirations. The faith by which a man lives must be in accord with the facts which men know. Only that religion, which is in harmony with the current scientific description of man and the universe, can maintain itself effectively in any age. No man ever committed himself to beliefs which he did not think were rational. It is therefore not only desirable but actually necessary for religion to take stock of contemporary insights into the nature of the world and of man, which science has gained.

The analysis of the atom and the study of the stars reveal the presence of cosmic forces which are coldly mathematical in their operations. The cosmic energy revealed to the physicist and astronomer has the attributes and characteristics of mind rather than of mechanics, of pure mathematics rather than of applied mathematics. It is gratifying, from certain points of view, to discover that the material universe is an expression of mentality, that mind is much more nearly omnipotent than matter, but the study of inanimate nature discloses no hint of goodness or loveliness, no clue concerning the relative value or merit of rival forms or patterns. No more sentiment is found in the structure of an atom than in the arrangements of a solar system or a stellar galaxy. The motive power of the universe is revealed as orderly and law-abiding; it produces form from formlessness, develops a cosmos from a chaos; but these patterns of expression contain nothing to inspire man to strive toward the realization of high ideals.

On the other hand, the geologist and the biologist have gained insight concerning additional characteristics of creative energy by their investigations of the evolution of living creatures during past and present time. When the motive power of the universe expresses itself in the form of cells, organized into animals and plants, it displays attributes not suspected from the study of crystals and stars. Living creatures are characterized by certain qualities and attributes which distinguish them unmistakably from all other expressions of cosmic energy.

The differences are not nearly so distinct and conspicuous as at first glance they appear to most of us to be. Certain expressions of inanimate nature very nearly duplicate certain qualities of animate nature. Nevertheless, there are real distinctions; the living is different from the non-living. The behavior of animals and plants involves processes and forces not apparent in the behavior of minerals and stones. Probably the most significant difference is indicated by what we call consciousness. Prod a live ameba with a needle, and it will indicate by its behavior that it is aware of this untoward circumstance in its physical environment. Treat a crystal of quartz in a similar manner, and there is absolutely no response indicative of awareness of the external stimulus.

Consciousness is an expression of cosmic energy, revealed in a certain organization of matter. I presume this characteristic explains the fact that cells have changed during geologic time, whereas crystals have remained the same throughout the entire history of the earth.

At some definite date in the earlier history of the earth there emerged from the non-living chemical compounds of which the earth's outer shell was composed, the first living cell. An attribute of cosmic energy, consciousness, was then displayed for the first time in this particular corner of the universe. Something new had appeared under the sun. The process of organic evolution was inaugurated. Characteristics of the administration of the universe which had hitherto been completely concealed were now to be revealed.

As that process continued to unfold, consciousness expanded and developed. Animals, ere long, were so organized that individuals became aware of environmental factors at ever increasing distances from themselves, and of elements in their surroundings to which they had previously made no response. The senses of sight, hearing and smell were added to those of touch and taste, and the capacity of awareness was tremendously increased. The behavior of most of the so-called lower animals indicates an awareness of physical factors only, but somewhere in the process of life development there emerged a new type of awareness, the type which is uniquely developed in mankind. Non-physical stimuli began to be appreciated.

Late in the history of the earth, a creature appeared which occasionally responds to the beauty of the sunset and the glory of the dawn. Man is to-day not simply aware of the physical events transpiring at remote distances from himself on other continents and in other stellar galaxies, he also responds to forces which we do well to call spiritual. He is moved by the call to duty; he is stirred by high ideals and noble aspirations. He has a keen desire to discover goodness,

moral law, righteousness. On occasion he has been known even to commit biologic suicide for a cause or purpose which he holds dearer than life itself. He has become aware of the qualities as well as the quantities of cosmic energy. He is conscious of a world of values as well as a world of matter. Again, a new attribute of administrative energy had become apparent in the behavior of that which it had produced.

The emergence of personality in the evolutionary process is an event of transcendent importance, the full meaning of which is still unappreciated. It must have occurred, however, in response to personality-producing forces in the universe. It is to these particular portions of cosmic energy that I would apply the term God. For me, God is the motive power which tends to produce a fine personality in a human being. Does God, as thus defined, deserve to be called loving or good? It all depends upon whether the personalities which are produced are kindly and good. If one believes that there are kindly personalities and good human beings, then one must attribute to cosmic energy the qualities which the theologian has in mind when he announces that God is love.

Regardless of the theological implication, it is now apparent that, as Professor H. S. Jennings expresses it, "thoughts, ideals, purposes, are among the determining factors for the happenings in nature. Aspirations do influence the course of events."

The history of evolution leads to the inference that its motive forces behave not like a well-designed machine but like a consistent personality. There is uni-

formity of purpose, rather than uniformity of action. New conditions permit the exemplification of new laws or principles of nature, the expression of hitherto unexpressed characteristics or phases of cosmic energy. In this sense, the laws of nature are not immutable. "What is to come in the future is not predictable from what has occurred in the past." It is to-day entirely rational to hope and strive for the appearance in the future of things never yet accomplished. In other words, by way of specific illustration, the fact that wars have punctuated the history of international relations throughout the entire life of mankind is no indication that nations must always arm themselves for war.

There is that in the structure of the universe which in the last few million years of geologic time, in at least one small corner of astronomic space, has been promoting the display of good-will, the aspiration toward brotherliness, the appreciation of beauty, the yearning toward loveliness of character and action. Man is not simply at home in the universe revealed by modern science; his nature has been highly approved and beneficently fostered by the sum total of the cosmic forces which play in upon him from without and well up within him like fountains of sweet water in the sea. If it be good for man to have come into existence upon the earth, then are the motive powers of the universe good.

The record of geologic life development leads directly to the inference that the desires and ambitions of living organisms are determining factors in the operations of the universe. Things are done in order that certain objectives may be reached in the future.

Life, the product of creative energy, is itself creative. And an essential element in its creative activities is provided by the freedom for self-expression possessed by individual organisms. Volition enters into the process of organic evolution all along the way, but becomes increasingly important as animals become more capable.

There seems to be nothing inherent in the known mechanisms of the evolutionary process which makes that process necessarily one of improvement and progress. But we cannot deny that it has been progressive. The earth is better now than it was two billion years ago when no living creature was upon its surface. More expressions of the nature of cosmic energy have been apparent in each succeeding geologic period. Finer qualities of the motive power of the universe are to-day manifest in the world of sense perception than were previously displayed, if we have any basis whatever for passing judgment upon such things.

It is sometimes suggested that our belief in the success of the evolutionary processes is just one more indication of the supreme egotism of mankind. We designate animals as "higher" or "better" simply because they approximate more closely the structures or attainments of man himself. If all our standards of judgment are human standards, they are not a valid basis for the conclusion that there has been any real progress in life development. What right have we to assume that the universe as a whole is any better because man lives and fights and loves upon the earth? There is, however, one basis for evaluating attainments and estimating progress, which has more than a

suggestion of being impersonal and universal. In how many ways may the vital energy which actuates an individual display itself to other individuals? Without raising any question concerning which expression of creative personality is better and which is poorer, a purely quantitative and coldly mathematical estimate may be made. In how many ways can an individual express its personality; the earthworm and the elephant, the bird and the fish, the dinosaur and the man? Obviously, the evolutionary processes have succeeded in producing individuals which in successive periods of time must be rated higher on this quantitative scale.

This and every other form of progress in evolution seems to have been attained because the individuals involved in the process were concerned with their own future and occasionally improved their opportunities to consummate their purposes. Purpose has been an attribute of nature at least as long as squirrels have gathered acorns for the coming winter or men have assembled in councils of war or peace. Viewed in the long perspective of geologic history, the purposes of nature seem to be experimental rather than pre-determined. The goals which life has set are not final; instead each seems to be immediate and temporary. The attainment of an aim, which for a time was set for a particular group of creatures, has in the past provided simply a new starting point for renewed experiments in ways and means of reaching some new and more progressive ideal. It may be that through the ages one increasing purpose runs, but what its final end may be is not at present apparent to the mind of

man. The scientist must be skeptical that there is any final goal; rather he would anticipate that always new purposes will arise just as soon as an old purpose has been consummated. Life is characterized by a ceaseless urge; should it stop developing it would no longer be life. The process continues from goal to goal, with never a final limit. Eye hath not seen, ear hath not heard, neither hath it entered into the mind of man, the things that are possible for cosmic energy to do in the sort of universe which man is gradually learning to appreciate.

Certainly, it is only during recent geologic time that nature has definitely set itself to the task of producing a man. Nothing in the evolution of Paleozoic animals, for example, offers the least suggestion that there was then the purpose of creating a biped mammal which would specialize in mentality. On the contrary, the particular modifications in the anatomy of fishes, which made possible the rise of air-breathing amphibians, among whom must have been the remote ancestors of man, were actually inimical to the development of brains. It required the long dark ages of the Mesozoic era, with its conquering horde of cold-blooded, small-brained reptiles, before that handicap was overcome and the palm of victory could be awarded to wits rather than weight, to mind rather than muscle. Many of the anatomical details of the human body are even yet a handicap to a creature who habitually stands in an erect attitude upon his hind limbs. They were obviously designed for a quadruped rather than a biped. So far as his body structure is concerned, man is at best an afterthought of nature.

Nevertheless, short-sighted though the evolutionary forces seem to be, the fact is that in regular sequence increasingly efficient types of animals and plants have made their appearance upon the earth. Especially significant is the improvement in mental ability, which has characterized each step along the pathway that leads from the primitive mammals to man. Because the sum total of his environment has favored brains and mentality, man is to-day in his present position of obvious power. Furthermore, the record in the rocks indicates the gradual emergence of the spirit of co-operation. The geologist can tell approximately when mother-love was born upon the earth. Especially in the strain that led to man has the emphasis been placed upon the widening spread and deepening hold of habits and ideals of co-operation and brotherliness. Social comity has lately emerged as a powerful directing force in that part of the universe about which we know the most. And social comity is a highly valuable ideal, regardless of whether we call it simply the "higher selfishness" or label it more grandly as "unselfishness." The experimental purposes of nature are justified by the results already attained and therefore provide a firm basis for an optimistic outlook into the future.

In the past, successful advances along the path of life were made by a small minority of individuals, here and there, who capitalized to the full the innate ability with which they were endowed and grasped every opportunity offered by their environment. In each case, they strove to accomplish that which never before had been achieved. If man sets as his goal merely long-continued existence on the present level,

then he should try to be true to himself, to express more completely his own personality, to be as efficient a man as possible. But if he wishes to hand on the torch of evolutionary progress to a posterity better than he, if he desires to participate in the upward as well as the onward march of living beings, then he must aim higher than that. What his aim should be, it is the task of enlightened religion to discover.

Evolution, as we understand it to-day, does not guarantee success, progress or improvement to man or any other creature. The fact that man has ascended from a lowly origin does not indicate that he must necessarily climb still higher. Instead, the evolutionary processes guarantee to man an opportunity which is in all likelihood the greatest opportunity vouchsafed to any creature that has thus far lived upon the earth. Co-equal to that opportunity is the responsibility which to-day rests upon the shoulders of mankind. That responsibility is no greater, in proportion to the abilities of human beings, than was the responsibility which rested upon the three-toed horse or the agile trilobite, each in its own day, but because of man's superior mental ability and broader consciousness it is the greatest responsibility which has ever been placed upon an offspring of Mother Earth.

The experiment in which man is involved appears to be that of developing a social order in which the values of individual personalities and divergent creative abilities shall be conserved to the full. The attempt to evolve a fine social order has been made several times in the past by several different species of animal, running the gamut from corals to insects, and

some of these earlier experiments have proved highly satisfactory. But in each instance, as among the social insects, the perfecting of the society has been accomplished by sacrificing the individual. The value of creative personality has been overlooked; the aim has been epitomized by the motto "one for all." But man is trying the more difficult experiment: his motto is "one for all and all for one." Whether or not he will succeed is at the present moment an open question; it is truly an experiment, the outcome of which is not now known. The record of the past gives rich basis for high hope that human nature will be able to stand the strain and win through to the goal. Our venture of faith is adequately justified by all that we know; but our actions must be based just as much on faith as on knowledge. Therefore, religion and science are both necessary, if man is to seize his opportunity and do his utmost to make successful the contemporary experiment into which cosmic energy has launched him.

Many of our social and spiritual ideals are imposed upon us by the environmental factors with which we are surrounded or are determined for us by the resources available for our hands and hearts and brains. Man is unquestionably the child of geologic circumstances, but he need not always remain the slave of circumstance. A creature of habit, he is not necessarily a victim of habit. He bears witness to the emergence in time and space of a new sort of creative ability. He may select from several possible goals the particular one toward which he will strive to go. If he pleases to do so, he may co-operate with those forces of nature which are creating the new and finer patterns of life. If he wills otherwise, he may refuse

to live in harmony with them, and thus he may long delay the achievement of those purposes which characterize the local scene.

The laws of nature are not chains which shackle man, nor goads which drive him down any pre-determined alley. They are tools which strengthen his hands and increase his efficiency; implements which have waited long for his master mind to make them useful. As science discovers the modes of operation of the manifold processes of nature, it provides the ways and means by which the world may be shaped nearer to the desire of human hearts. But it is the dual prerogative of religion to paint the picture of the world that ought to be, and to inspire men with zeal adequate for its realization.

Most unscientific of all the popular slogans which unwittingly sap the very foundations of religion is the statement that "human nature cannot be changed." Not only is it true that every product of natural processes is undergoing change, it is also true that man is one of the most plastic of all animals. His ways are not yet fixed; his nature not yet determined. One of the newest of the newcomers in the drama of life, his future is practically certain to be many times as long as his past. Still in the vigor of youth, this species of featherless biped possesses potentialities for modification far greater than most people think. Whether the changes in human nature, bound to occur in the next few thousand years, will be for better or for worse will largely be determined by the individuals who compose each successive generation.

Modern science does not sanction a religion which

is based solely upon traditions of the past, or which looks to magic formulas and miracle-working ordinances as the means of accomplishing its purposes. Instead it approves a religion which constantly seeks for new and better light upon the pathway of life, which strives to make more effective the law-abiding operation of spiritual forces in the natural world, and which finds in the experiences of thoughtful men a sufficient guide to truth.

For such a religion, science provides not only the ways and means by which its goals may be attained, but also an insight into the nature of the world and of man which may well serve as an adequate foundation of facts upon which to erect the superstructure of faith, hope and love. This foundation stands four-square. It supports a confidence in the kindly thoughtfulness inherent in the administration of the universe, a sense of security for mankind in the midst of the uncertainties of life, a belief in the creative powers of human beings, and a hope for the future of humanity, individually and collectively. In building upon it the splendid edifice which any adequate religion ought to construct, there must be some standard of judgment or evaluation by means of which the architectural design may be appraised.

For the Christian religion, the scale of values is provided by our beliefs about Jesus of Nazareth. The Christian assumes that the teachings and life of Jesus, as he believes them to have been, represent truly the finest qualities of universal energy thus far displayed to man, and thus set the standard by which each individual may gauge his own ideals of conduct and philosophy of life. This assumption concerning

Jesus cannot be proved by any process of logic, but even as we may justify or validate a scientific assumption by trying it out to see how it works, so we may justify or validate this religious assumption by putting it to the practical test and observing how it works.

We are all in the midst of that experimental operation. If the attempt to put Christlike motives and ideals into practical operation among human beings succeeds in making life better, then we are justified in the assumption that we have made. Is the truly Christian way of life the finest and the best? There is only one method of answering the question, the scientific method,—try it and see.

CHRISTIANITY AND SCIENCE

ROBERT A. MILLIKAN

ROBERT ANDREWS MILLIKAN was born in 1868 in Morrison, Illinois. He has received degrees from several universities in the United States and Europe for illustrious work in the field of scientific research. At present he is director of the Norman Bridge Laboratory of Physics at the California Institute of Technology. In 1923 he was awarded the Nobel Prize in physics for isolating and measuring the ultimate unit, the electron, and for photo-electric researches. He has received medals from various societies organized to encourage the arts and sciences. He is author of volumes treating of physics and related subjects. Of late years he has displayed particular interest in the relations between science and religion, lecturing and writing extensively on that subject. He is also keenly interested in athletics; and is said to have followed his son Clark's representation of America in the high hurdles at Wimbledon in 1923 almost as eagerly as his own experiments which led to the measurement of the electron. Dr. Millikan holds fellowship with the Unitarian Church; and is an active layman in that body.



II

CHRISTIANITY AND SCIENCE¹

By ROBERT A. MILLIKAN

WHEN the life and teachings of Jesus became the basis of the religion of the whole western world, an event of stupendous importance for the destinies of mankind had certainly taken place, for a new set of ideals had been definitely and officially adopted by a very considerable fraction of the human race, a fraction which will be universally recognized to have held within it no small portion of the world's human energies and progressive capacities, and which has actually been to no small degree determinative of the direction of human progress.

The significance of this event is completely independent even of the historicity of Jesus. The service of the Christian religion, my own faith in essential Christianity, would not be diminished one iota if it should in some way be discovered that no such individual as Jesus ever existed. If the ideas and ideals for which he stood sprang up spontaneously in the minds of men without the stimulus of a single great character, the result would be even more wonderful and more inspiring than it is now, for it would mean that the spirit of Jesus actually is more widely spread throughout the world than we realize. In making

¹ From *Science and the New Civilization*. Copyright, 1930, by Charles Scribner's Sons. By permission of the publishers.

this statement, I am endeavoring to say just as positively and emphatically as I can, that the credentials of Jesus are found wholly in his teachings and in his character as recorded by his teachings, and not at all in any real or alleged historical events. And in making that affirmation, let me also emphasize the fact that I am only paraphrasing Jesus' own words when he refused to let his disciples rest his credentials on a sign.

My conception, then, of the essentials of religion, at least of the Christian religion, and no other need here be considered, is that those essentials consist in just two things: first, in inspiring mankind with the Christlike, that is, altruistic *ideal*, and that means specifically, *concern for the common good* as contrasted with one's own individual impulses and interests, wherever in one's own judgment the two come into conflict; and second, inspiring mankind to do, rather than merely to think about his duty, the definition of duty for each individual being what he himself conceives to be for the common good. In three words, I conceived the essential task of religion to be "to develop the consciences, the ideals and the aspirations of mankind."

It is very important to notice that in the definitions I have given, duty has nothing to do with what somebody else conceives to be the common good, for instance, with morality in the derivative sense of the mores of a people. Endless confusion and an appalling amount of futility gets into popular discussion merely because of a failure to differentiate between these two conceptions. As I shall use the words then, moral and immoral, or moral right and wrong, are

purely subjective terms. The question of what actually is for the common good is the whole stupendous problem of science in the broad sense of that term, that is, of knowledge, and has nothing to do with religion or with morals as I am using these words.

There are only two kinds of moral conduct. The first is due to indifference, thoughtlessness, failure to reflect upon what is for the common good, in other words, careless, impulsive, unreflective living on the part of people who know that they ought at least to try to think things through. I suspect that ninety-nine per cent of all immorality is of this type and that this furnishes the *chief reason for religious effort and the chief field for religious activity*. For both example and precept unquestionably have the power to increase the relatively small fraction of the population that attempts to be reflectively moral. The second type of immorality is represented by "the unpardonable sin" of which Jesus spoke: deliberate refusal, after reflection, to follow the light when seen.

Thus far, I have been dealing only with what seem to me to be obvious facts, mere platitudes, if you will, for the sake of not being misunderstood when I speak about the essentials of religion. I am not at this moment concerned with how far the practice of religion has at times fallen short of the ideals stated in the foregoing essentials. I am now merely reaffirming the belief with which I began, and which I suspect that, after the foregoing explanations, not many will question, though I know there are some who will, that the discovery of the foregoing ideals, and their official adoption as the basis of the religion of the

western world has within the past two thousand years exercised a far-reaching influence upon the destinies of the race.

But I am going to go farther and express some convictions about the relation of those ideals not only to the past but also to the present and to the future. I am going to affirm that those ideals are the most potent and significant element in the religion of the western world to-day. It is true that many individual western religions contain some elements in addition to these, some of them good, some harmless, some bad, and that the good and the bad are so mixed in some of them that it is not always easy, even from my own point of view, to determine whether a given branch of religion is worth while or not. Nevertheless, looking at western religion as a whole, the following facts seem to me obvious and very significant.

First, that if the basis of western religion is to be found in the element that is common to all its branches, then the one indispensable element in it now is just that element that formed the center of Jesus' teaching; and that I have called above the essence of religion. Second, that no man who believes in the fundamental value for the modern world of the essentials of religion as defined above, and in the necessity for the definite organization of religion for the sake of making it socially effective, needs to withdraw himself from the religious groups, and thereby to exert his personal influence against the spread of the essential religious ideals, since in America, at least, he will have no difficulty in finding religious groups who demand nothing of their adherents more than the belief in the foregoing ideals, added to an honest effort to live in

conformity with them. Third, that a very large fraction of the altruistic and humanitarian and forward-looking work of the world, in all its forms, has to-day its mainspring in the Christian churches. My own judgment is that about ninety-five per cent of it has come, and is coming, directly or indirectly, from the influence of organized religion in the United States. My own judgment is that, if the influence of American churches in the furtherance of socially wholesome and forward-looking movements, in the spread of conscientious and unselfish living of all sorts, were to be eliminated, our democracy would in a few years become so corrupt that it could not endure. These last two are, however, merely individual judgments, the correctness of which I cannot prove.

Now looking to the influence of religion in the future, I have in the preceding found the essence of the gospel of Jesus in the Golden Rule, which, broadly interpreted, means the development in the individual of a sense of social responsibility. Civilization itself is dependent in the last analysis primarily upon just this thing. The change from the individual life of the animal to the group life of civilized man, especially in the world of science, a life of ever-expanding complexity as our scientific civilization advances, is obviously impossible unless, in general, the individual learns in ever-increasing measure, to subordinate his impulses and interests to the furtherance of the group life. The reason that the western world, which has led, as we westerners think, in the development of civilization, adopted Christianity as its religion is to be found in the last analysis, in the fact that western civiliza-

tion with its highly organized group life found that it could not possibly develop without it. And if this is so, the future is certainly going to need the essentials of Christianity even more than the past has needed them.

In other words, the job that the churches in the past have been in the main trying to do, and the job that, I think, in spite of their weakness and follies, they have in the main succeeded in doing fairly well; namely, the job of developing the consciences, the ideals and the aspirations of mankind, must be done by some agency in the future even more effectively than it has been done in the past.

There are two ways in which this can be done: First, by destroying organized religion as Russia recently has been attempting to do, and building upon its ruins some other organization which will carry on the work that the church has in the main done in the past, some other organization which will embody the essentials of religion, but be free from its faults. The second way is to assist organized religion as it now exists to eliminate its faults and to be more effective in emphasizing and in spreading, with ever-increasing vigor, its essentials.

The idea that God, or Nature, or the Universe, whatever term you prefer, is not a being of caprice and whim as had been the case in all the main body of thinking of the ancient world; but is, instead, a God who rules through law, or a nature capable of being depended upon, or a universe of consistency, or orderliness and of the beauty that goes with the order—that idea has *made* modern science, and it is unquestionably the foundation of modern civilizations.

Yes, and much more than this, for it is not merely the material side of life that this idea has changed. It has also revolutionized the whole mode of thought of the race. It has changed the philosophic and religious conceptions of mankind. It has laid the foundations of a new and a stupendous advance in man's conception of God, for a sublimer view of the world and of man's place and destiny in it. The anthropomorphic God of the ancient world, the God of human passions, frailties, caprices, and whims is gone, and obviously with it the old duty, namely, merely or chiefly the duty to propitiate him, so that he may be induced to treat you, either in this world or the next, or in both, better than he treats your neighbor.

Can any one question the advance that has been made in the diminishing prevalence of these mediæval, essentially childish, and essentially selfish ideas? The new God is the God of law and order; the new duty, to know that order and to get into harmony with it; to learn how to make the world a better place to live in, not merely how to save your individual soul. However, once destroy our confidence in the principle of uniformity, our belief in the rule of law, and our effectiveness immediately disappears, our method ceases to be dependable, and our laboratories become deserted.

Matter is no longer a mere game of marbles played by blind men. An atom is now an amazingly complicated *organism*, possessing many interrelated parts, and exhibiting many functions and properties—energy properties, radiating properties, wave properties, and other properties quite as mysterious as any that used to masquerade under the name of "mind," so that the phrases, "all is matter," and "all is mind," have now

become merely shibboleths completely devoid of meaning.

Personally I believe that essential religion is one of the world's supremest needs. And I believe that one of the greatest contributions the United States ever can, or ever will, make to world progress—greater by far than any contribution which we ever can make to the science of government—will consist in furnishing an example to the world of how the religious life of a nation can evolve intelligently, wholesomely, inspiringly, reverently, completely divorced from all unreason, all superstition, and all unwholesome emotionalism.²

We can still look with a sense of wonder and mystery and reverence upon the fundamental elements of the physical world as they have been partially revealed to us in this century. The childish mechanical conceptions of the nineteenth century are now grotesquely inadequate.

We have at present no one consistent scheme of interpretation of physical phenomena, and we have become wise enough to see, and to admit, that we have none. We use the wave theory, for example, where it works; we use the quantum theory where it works; and we try to bridge the gap between the two apparently contradictory theories, in purely formal fashion, by what we call the correspondence principle. It is true we are still slowly learning more of the rules of nature's game, so that our progress is not made by hit or miss experimenting, nor by random theorizing, but

² The following pages are reprinted from *Evolution of Science and Religion*. By permission of The Yale University Press, publishers.

by following a more or less systematic, if not always a strictly logical, procedure. But the day has gone by when any physicist thinks he understands the foundations of the physical universe, as we thought we understood them in the nineteenth century. The discoveries of our generation have taught us a wholesome lesson of humility, wonder and joy in the face of an as yet incomprehensible physical universe.

We have learned not to take ourselves as seriously as the nineteenth century physicists took themselves. We have learned to work with new satisfaction, new hope and new enthusiasm because there is still so much that we do not understand, and because, instead of having it all pigeon-holed as they thought they had, we have found in our lifetimes more new relations in physics than had come to light in all preceding ages put together, and because the stream of discovery as yet shows no abatement.

Why is it that we have never surpassed the sepulchral decorative art of the Egyptians, nor their sepulchral architecture, either? Is it not because they, too, at least, in some of the fields in which they worked, discovered eternal truth? Why is it that in the plastic arts, in æsthetics, in certain forms of the drama, in the exercise of pure reason, we can only imitate the triumphs of the Greeks? Is it not because the Greeks discovered in these fields eternal truth? Why is it that all the world is still willing to say of Jesus, "Never man spake like this man"? Is it not because he literally spake two thousand years ago the words of everlasting life—the words of rich, full, abundant, satisfying, unselfish living for all times and all places?

There is a truth in the past which cannot be ignored or brushed thoughtlessly aside by men of insight and understanding. Much of the knowledge of the past is still eternal truth. As Einstein embraces the whole of Newton, so presumably the truth of the present is merely a supplement to, an extension of, the truth of the past. It takes on a new aspect, a richer, completer significance with every advance in knowledge; but only the undiscerning and the thoughtless fail to see the truth that was clothed in the old dress—fail to see, in a word, that this whole process of which we are a part is a slow continuing growth. If it fails to appear as such at times it is only because we have not a wide enough perspective, because our candidate, for example, has been defeated at the polls, and we accordingly think for the moment that the whole march of progress has been reversed. At such times we need to reflect upon such a bit of doggerel as appeared some years ago in the *Outlook* just after its candidate and its policies had suffered disastrous overthrow:

My grandad notes the world's worn cogs
And says we're going to the dogs.
His grandad in his house of logs
Thought things were going to the dogs.
His dad among the Flemish bogs,
Swore things were going to the dogs.
The cave man in his queer skin togs
Knew things were going to the dogs.
Yet this is what I'd like to state,
Those dogs have had an awful wait.

The undiscerning and the thoughtless are divided into two great groups, the one the conventional crowd which simply passes on the past without change; the

other, the red mob, the devotees of the next easiest and cheapest philosophy, "the philosophy of knock." The unthinking join each of these two groups in crowds. But the man of education and intelligence in general joins neither. Indeed, is not the main purpose of education to enable one to know the truth of the present, and to understand the truth of the past. In a word, is it not to enable one to estimate correctly his own place and that of his contemporaries in the ever-expanding ocean of knowledge; for only with such understanding can he shake off the inhibitions of the conventional, free himself from the emotional futility of the radical, and put forth constructive effort for the real betterment of the world.

One or two illustrations of effort that is not constructive will be illuminating. After the discovery of the law of gravitation all attempts to make new physical or engineering developments, save such as are consistent with and limited by this law, became, of course, ridiculous, since they ignore fundamental and established truth. The same is true with respect to proposed violations of the principle of conservation of energy and the laws of electrodynamics as applied to large-scale phenomena. But this ridiculousness does not prevent inventors without background from continually putting forward perpetual motion machines, nor does it prevent ignorant or unscrupulous persons from advertising Abrams electronic reactions, magnetic belts, and the like.

Also such persons undoubtedly have their exact counterparts in the fields of art, finance, education, and all other departments of human activity, persons who are ignorant of fundamental laws that have been

discovered; who are hypnotized by anything which is new because it is new; and who are not interested in first finding what has been found to be true. There are presumably fundamental laws in art as well as in physics, in accordance with which all real progress must be made. One of the foremost painters in the United States recently told me that he considered a very large fraction of what is called modern art to be in the precise category of perpetual motion machines and Abrams electronic reactions—a violation of the fundamental laws of real art, and hence doomed to disappear like all other untrue things. And how many cubists we have in economics, in education, in government, in religion, everybody knows,—persons who are unwilling to take the time and to make the effort required to find what the known facts are, before they become champions of unsupported opinions—people who take sides first and look up facts afterward when the tendency to distort the facts to conform to the opinions has become well-nigh irresistible.

The assumption that our feeble, finite minds understand completely the basis of the physical universe is the sort of blunder that has been made over and over and over again throughout all periods of the world's history, and in all domains of thought. It is the essence of dogmatism—assertiveness without knowledge. This is supposed to have been the especial prerogative of religion; and there have been many religious dogmatists; but not a few of them, alas, among scientists. Every one will recognize Mr. Bryan, for example, as a pure dogmatist; but not

every scientist will recognize that Ernst Haeckel was an even purer one.

If there is anything that is calculated to impart an attitude of humility and of reverence in the face of nature, to keep one receptive of new truth and conscious of the limitations of our finite understanding, it is a bit of familiarity with the growth of modern physics. It is quite as effective as the "tropic forests" which put Charles Darwin into such an attitude of reverence when he wrote, "No man can stand in the tropic forests without feeling that they are temples filled with the various productions of the God of nature, and that there is more in man than the breath of his body."

No conception of God which has ever come into human thinking has been half so productive of effort on the part of man to change bad conditions as has this new modern conception that man himself plays a part in the scheme of evolution; this conception that has arisen because of work like that of Galileo, like that of Pasteur, and especially like that of Franklin and Faraday, that it is possible in increasing measure for us to know and to control, nature. This conception has inevitably been introduced into human thinking by the stupendous strides which have been made in the past century. And there are perhaps limitless possibilities ahead through the use of the scientific method for the enrichment of life and the development of the race.

In this sense the idea that nature is at bottom benevolent has now become well-nigh universal. It is

a contribution of science to religion, and a powerful extension or modification of the idea that Jesus saw so clearly and preached so persistently. He had felt that benevolence, and then preached it among men. Modern science has brought forward evidence for its belief. True, it has changed somewhat the conception and the emphasis, as was to have been expected, for it is this constant change in conception with the advance of thought and of knowledge that we are here attempting to follow. But the practical preaching of modern science—and it is the most insistent and effective preacher in the world to-day—is extraordinarily like the preaching of Jesus.

Its keynote is service, the subordination of the individual to the good of the whole. Jesus preached it as a duty—for the sake of world salvation. Science preaches it as a duty—for the sake of world progress. Jesus also preached the joy and satisfaction of service: "He that findeth his life shall lose it; and he that loseth his life . . . shall find it." When the modern scientist says he does it "for the fun of it," or "for the satisfaction he gets out of it," he is only translating the words of Jesus into the modern vernacular. It would be hard to find a closer parallel.

Concerning what ultimately becomes of the individual in the process, science has added nothing and it has subtracted nothing. So far as science is concerned religion can treat that problem precisely as it has in the past; or it can treat it in some entirely new way if it wishes. For that problem is entirely outside the field of science now, though it need not always remain so. Science has undoubtedly been responsible for a certain change in religious thinking as to the relative values

of individual and race salvation. For obviously by definitely introducing the most stimulating and inspiring motive for altruistic effort which has ever been introduced, namely, the motive arising from the conviction that we ourselves may be vital agents in the march of things, science has provided a reason for altruistic effort which is quite independent of the ultimate destination of the individual, and is also much more alluring to some sorts of minds than that of singing hosannas forever around the throne. To that extent science is undoubtedly influencing and changing religion quite profoundly now.

The emphasis of making this world better is certainly the dominant and characteristic element in the religion of to-day. Nor is it confined to the formal religious organizations, though it probably gains its chief impulse from them. For this new idea of progress, and of our part in it, and our responsibility for it, is now practically universal. Call it an illusion if you wish; you at least cannot deny the existence of the idea; and it is ideas that count in this world, for in them is, of course, the motivation of all conduct. For my own part I am going to call this introduction of an idea as divine an event as has ever taken place. It is due directly to science, and it marks the latest stage in the evolution of religion, that is, the latest stage in the evolution of man's conceptions about the ultimate nature of his world and his relations to that world—his conceptions about God and about duty.

It is not a question of whether one is religious or irreligious, so much as whether one is scientific or unscientific, rational or irrational. The world is of

course "incurably religious." Why? Because every one who reflects at all must have conceptions about the world which go beyond the field of science, that is, beyond the present range of intellectual knowledge. As soon as we get beyond that range we are in the field that belongs to religion, and no one knows better than the man who works in science how soon we get beyond the boundaries of the known. These boundaries are continually changing, and so the conceptions that must start from them and have their footings in them are likewise of necessity changing. That is, religion is changing now, because of the interplay of science upon it, precisely as it has been changing in the past, and especially during the past century.

There is a religion—one which keeps its mind continually open to new truth, which realizes that religion itself has continually undergone an evolution, that as our religious conceptions have changed in the past so they may be expected to change in the future; that eternal truth has been discovered in the past, that it is being discovered now, and will continue to be discovered. That kind of religion adapts itself to a growing, developing world.

Physics has recently learned its lesson; and it has something to teach both philosophy and religion, namely, the lesson of not taking itself too seriously, not imagining that the human mind yet understands, or has made more than the barest beginning toward understanding the universe. To-day physics is much more open-minded, much less dogmatic, much less disposed to make all-inclusive generalizations, and to imagine that it is dealing with ultimate realities, than

it was twenty-five years ago. This generalizing further than the observed facts warrant; this tendency to assume that our finite minds have at any time attained to a complete understanding even of the basis of the physical universe, this sort of blunder has been made over and over again in all periods of the world's history, and in all domains of thought. It has been the chief sin of philosophy, the gravest error of religion, and the worst stupidity of science—this assumption of unpossessed knowledge, this dogmatic assertiveness, sometimes positive, sometimes negative, about matters concerning which we have no knowledge.

If, as we pass from the seven-year-old to the thirty-year-old stage of our racial development, our conceptions of God become less childishly simple, more vague and indefinite, it is because we begin to realize that our finite minds have only just begun to touch the borders of the ocean of knowledge and understanding. "Canst thou by searching find out God?"

The prophet Micah said, twenty-five hundred years ago, "What doth the Lord require of thee but to do justice, to love mercy, and to walk humbly with thy God?" Modern science of the real sort is learning to walk humbly with its God. And in learning that lesson it is contributing something to religion.

SCIENCE REVERENT BEFORE COSMIC
WONDER

ARTHUR S. EDDINGTON

ARTHUR STANLEY EDDINGTON, Plumian Professor of Astronomy, Cambridge, England, since 1913, and director of the observatory there since 1914, was born in Kendal in 1882, and is unmarried. Manchester, Oxford, Dublin, Bristol and Edinburgh have conferred distinguished degrees upon him. He was president of the Royal Astronomical Society, 1921-1923; Chief Assistant at the Royal Observatory, Greenwich, 1906-1913. In 1928 he was awarded the Royal Medal of the Royal Society. He has written widely on subjects dealing with physics, mathematics and astronomy. But before the appearance of his epoch-making volume, *The Nature of the Physical World*, in 1928, Professor Eddington was not known outside the circle of his fellow scientists. With publication of that book, however, he acquired world-wide reputation as an exponent of Einstein's theory of relativity; and also as a scientist who did not fear to approach research in the spirit of the idealist and the mystic. Publication of *The Nature of the Physical World* was the signal for the appearance of many books by scientists, conceding abandonment of the mechanistic theory of the universe in favor of a theory involving infinite purpose and direction back of cosmic phenomena. In this sense Eddington's work marked the beginning of an epoch in scientific thinking. Others had commenced to think in similar terms; but it remained for him to focus public attention. Professor Eddington is an earnest Quaker; and into his work intrudes considerable of the quiet faith and mysticism of that noble belief.



III

SCIENCE REVERENT BEFORE COSMIC WONDER¹

By ARTHUR S. EDDINGTON

SOME would put the question in this form: "Is the unseen world revealed by the mystical outlook a reality?" Reality is one of those indeterminate words which might lead to infinite philosophical discussions and irrelevancies. There is less danger of misunderstandings if we put the question in this form: "Are we, in pursuing the mystical outlook, facing the hard facts of experience?"

Surely we are. I think that those who would wish to take cognisance of nothing but the measurements of the scientific world made by our sense-organs are shirking one of the most immediate facts of experience, namely, that consciousness is not wholly, nor even primarily a device for receiving sense-impressions.

We may the more boldly insist that there is another outlook than the scientific one, because in practice a more transcendental outlook is almost universally admitted. I cannot do better than quote a memorable description by J. S. Holland:

"There is an hour of the Indian night, a little before the first glimmer of dawn, when the stars are unbelievably clear and close above, shining with a radiance beyond our belief in this foggy land. The

¹ From *Science and the Unseen World*, by Arthur S. Eddington. By permission of the Macmillan Company, publishers.

trees stand silent around one with a friendly presence. As yet there is no sound from awakening birds; but the whole world seems to be intent, alive, listening, eager. At such a moment the veil between the things that are seen and the things that are unseen becomes so thin as to interpose scarcely any barrier at all between the eternal beauty and truth and the soul which would comprehend them."

Here is an experience which the "observer," as technically defined in scientific theory, knows nothing of. The measuring appliances which he reads declare that the stars are just as remote as they always have been; nor can he find any excuse in his measures for the mystic thought which has taken possession of the mind and dominated the sense impressions.

Yet who does not prize these moments that reveal to us the poetry of existence? We do not ask whether philosophy can justify such an outlook on nature. Rather our system of philosophy is itself on trial. It must stand or fall according as it is broad enough to find room for this experience as an element of life. The sense of values within us recognises that this is a test to be passed. It is as essential that our philosophy should survive this test as that it should survive the experimental tests supplied by science.

In the passage I have quoted there is no direct reference to religious mysticism. It describes an orientation towards nature, accepted by religious and irreligious alike, as proper to the human spirit—though not to the ideal "observer" whose judgments form the canon of scientific experience. The scientist who from time to time falls into such a mood does not feel guilty twinges as though he had lapsed in his devo-

tion. He would, on the contrary, feel deep concern if he found himself losing the power of entering into this kind of feeling. In short our environment may and should mean something towards us which is not to be measured with the tools of the physicist or described by the metrical symbols of the mathematician.

Let science pause before rushing in to apply a supposed scientific test; for such a test would go much too far, stripping away from our lives not only our religion but all our feelings which do not belong to the function of a measuring machine.²

We are anxious for perfect truth; but it is hard to say in what form perfect truth is to be found. I cannot quite believe that it has the form typified by an inventory. Somehow, as part of its perfection, there should be incorporated in it that which we esteem as a "sense of proportion." The physicist is not conscious of any disloyalty to truth on occasions when his sense of proportion tells him to regard a plank as continuous material, well knowing that it is "really" empty space containing sparsely scattered electric charges. And the deepest philosophic researches as to the nature of the Deity may give a conception equally out of proportion for daily life; so that we should rather employ a conception that was unfolded nearly two thousand years ago.

I am standing on the threshold about to enter a room. It is a complicated business. In the first place I must shove against an atmosphere pressing with a

² The following pages are from *The Nature of the Physical World*, by Arthur S. Eddington. By permission of the Macmillan Company, publishers.

force of fourteen pounds on every square inch of my body. I must make sure of landing on a plank travelling at twenty miles a second round the sun—a fraction of a second too early or too late, the plank would be miles away. I must do this while hanging from a round planet head outward into space, and with a wind of ether blowing at no one knows how many miles a second through every interstice of my body. The plank has no solidity of substance. To step on it is like stepping on a swarm of flies. Shall I not slip through? No, if I make the venture one of the flies hits me and gives me a boost up again. I fall once more and am knocked upwards by another fly; and so on.

I may hope that the net result will be that I remain about steady; but if unfortunately I should slip through the door or be boosted too violently up to the ceiling, the occurrence would be, not a violation of the laws of nature, but a rare coincidence. These are some of the minor difficulties. I ought really to look at the problem four-dimensionally as concerning the intersection of my world-line with that of the plank. Then again, it is necessary to determine in which direction the entropy of the world is increasing in order to make sure that my passage over the threshold is an entrance, not an exit.

Verily, it is easier for a camel to pass through the eye of a needle than for a scientific man to pass through a door. And whether the door be barn door or church door it might be wiser that he should consent to be an ordinary man and walk in, rather than wait till all the difficulties involved in a really scientific ingress are resolved.

Starting from æther, electrons and other physical machinery we cannot reach conscious man and render count of what is apprehended in his consciousness. Conceivably we might reach a human machine interacting by reflexes with its environment; but we cannot reach rational man morally responsible to pursue the truth as to æther and electrons or to religion.

A belief, not by any means confined to the more dogmatic adherents of religion is that there is a future non-material existence in store for us. Heaven is nowhere in space, but it is in time. (All the meaning of the belief is bound up with the word *future*; there is no comfort in an assurance of bliss in some *former* state of existence.) On the other hand the scientist declares that time and space are a single continuum; and the modern idea of a Heaven in time but not in space is in this respect more at variance with science than the pre-Copernican idea of a Heaven above our heads. The question I am now putting is not whether the theologian or the scientist is right; but which is trespassing on the domain of the other. Cannot theology dispose of the destinies of the human soul in a non-material way without trespassing on the realm of science? Cannot science assert its conclusions as to the geometry of the space-time continuum without trespassing on the realm of theology? According to the above assertion science and theology can make what mistakes they please provided that they make them *in their own territory*. They cannot quarrel if they keep to their own realms. But it will require a skilful drawing of the boundary line to frustrate the development of a conflict here.

The philosophic trend of modern scientific thought differs markedly from the views of thirty years ago. Can we guarantee that the next thirty years will not see another revolution, perhaps even a complete reaction? We may certainly expect great changes, and by that time many things will appear in a new aspect. That is one of the difficulties in the relations of science and philosophy: that is why the scientist as a rule pays so little heed to the philosophical implication of his own discoveries. By dogged endeavor he is slowly and torturously advancing to purer and purer truth; but his ideas seem to zigzag in a manner most disconcerting to the onlooker. Scientific discovery is like the fitting together of the pieces of a great jig-saw puzzle; a revolution of science does not mean that the pieces already arranged and interlocked have to be dispersed. It means that in fitting on fresh pieces we have had to revise our impression of what the puzzle-picture is going to be like.

One day you ask the scientist how he is getting on. He replies, "Finely. I have very nearly finished this piece of blue sky." Another day you ask how the sky is progressing and are told, "I have added a lot more, but it was sea, not sky; there is a boat floating on the top of it." Perhaps next time it will have turned out to be a parasol upside down; but our friend is still enthusiastically delighted with the progress he is making. The scientist has his guesses as to how the finished picture will work out; he depends largely on these in his search for other pieces to fit; but his guesses are modified from time to time by unexpected developments as the fitting proceeds.

These involutions of thought as to the final picture

do not cause the scientist to lose faith in his handiwork, for he is aware that the completed portion is growing steadily. Those who look over his shoulder and use the present partially developed picture for purposes outside science, do so at their own risk.

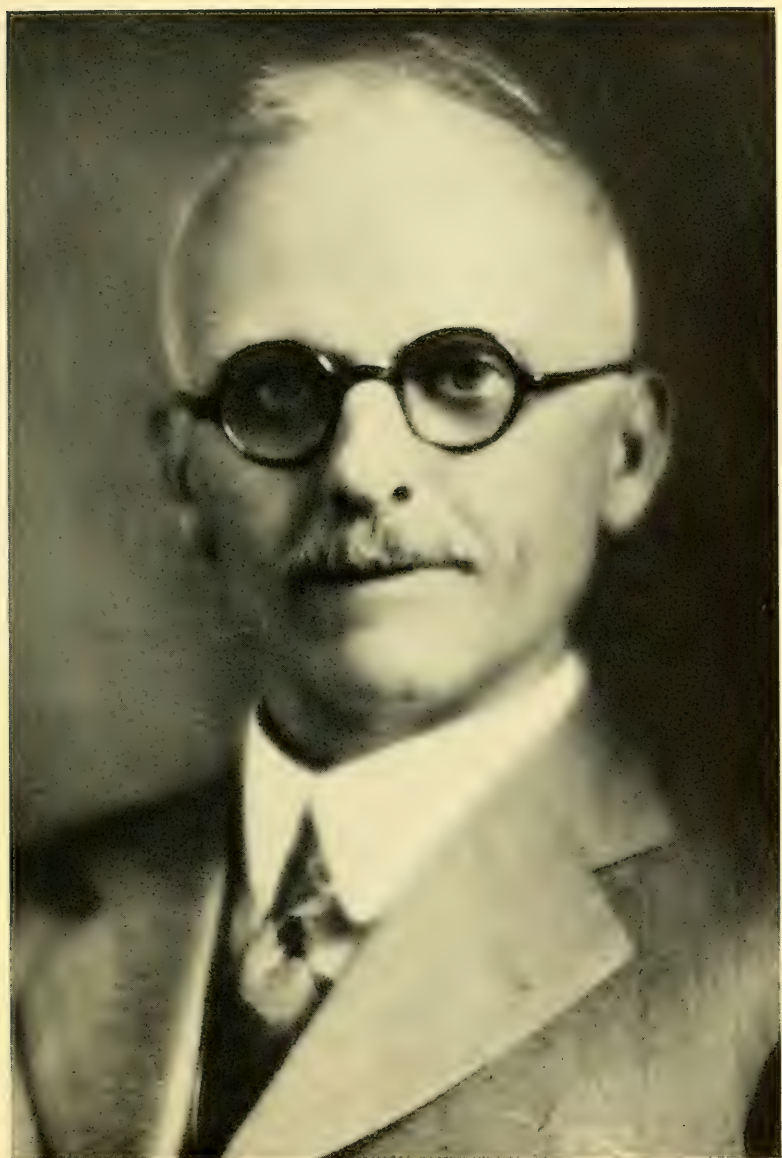
The lack of finality of scientific theories would be a very serious limitation of our argument, if we had staked much on their permanence. The religious reader may well be content that I have not offered him a God revealed by the quantum theory, and therefore liable to be swept away in the next scientific revolution. It is not so much the particular form that scientific theories have now taken—the conclusions which we believe we have proved—as the movement of thought behind them that concerns the philosopher. Our eyes once opened, we may pass on to a yet newer outlook on the world, but we can never go back to the old outlook.

If the scheme of philosophy which we now rear on the scientific advances of Einstein, Bohr, Rutherford and others, is doomed to fall in the next thirty years, it is not to be laid to their charge that we have gone astray. Like the systems of Euclid, of Ptolemy, of Newton, which have served their turn, so the systems of Einstein and Heisenberg may give way to some fuller realisation of the world. But in each revolution of scientific thought new words are set to the old music, and that which has gone before is not destroyed but refocussed. Amid all our faulty attempts at expression, the kernel of scientific truth steadily grows. And of this truth it may be said—The more it changes, the more it remains the same thing.

MODERN PHYSICAL SCIENCE: ITS RELATION TO RELIGION

HEBER D. CURTIS

HEBER DOUST CURTIS, astronomer, was born in Muskegon, Michigan, in 1872. In 1902 he received his Ph.D. from the University of Virginia, and in 1893 his A.M. from the University of Michigan. He began to teach astronomy in 1897, and ever since has devoted himself to that science. He has observed astronomical phenomena at various places in the United States, South America, Labrador, Russia and Sumatra. In this connection he has the unusual distinction of having observed nine total solar eclipses. He is member of the National Academy of Sciences, and the American Philosophical Society. He has made numerous contributions to scientific publications. Recently, he was appointed Director of the Detroit Observatory of the University of Michigan. The article he presents in this symposium is an expansion of an address delivered in the series of Faculty Religious Forums of the University of Pittsburgh, where for ten years he was director of the Alleghany observatory.



IV

MODERN PHYSICAL SCIENCE: ITS RELATION TO RELIGION

By HEBER D. CURTIS

IN any symposium or forum such as this, it is no easy matter to follow exactly and precisely a title as printed. Considerable thought has been given to various possibilities in the way of changes or alterations in this title, in the hope that it might thus be brought to indicate with greater precision the trend of the treatment to be followed. Some aspects of our analysis, as will be developed later, might well motivate a change to a title reading,—“The Analogies Between Religious and Modern Physical Beliefs.” But, as every librarian knows, any complete precision in a title will require so long a statement, such qualifications by way of definitions, exceptions noted, and explanations given, that a perfect title must finally become identical with the work itself.

Science is to-day taking stock of the beliefs it has permitted itself to make; in a closer alliance with that field formerly pre-empted by philosophy it has subjected its basal principles to close analysis. Somewhat to his surprise, the modern scientist finds that he has gradually and without prevision reached a point where he is permitting himself, even demanding, beliefs and theories which involve the transcendental and the infinite. It is with something of a shock

that science has suddenly found close analogy between its most cherished and latest beliefs and those of religion, in so far as both assume the transcendental and the unknowable. The survey of this common ground, a liaison obtained through a similarity of beliefs permissible, will form a large part of this treatment, even though not explicitly included in the title.

Shall I then, in attempting to amplify and elaborate this theme as assigned me, make a preliminary attempt to clarify the treatment by starting with definitions of the concepts involved? Perhaps this is not really necessary, yet it will serve to set certain limitations which I regard as vital. There are hundreds of excellent definitions of religion, and doubtless a different definition of the term would be given by each reader,—definitions which would in each case show radical variations from that given by one's neighbor. Yet in all such definitions there are certain elements in common, so generally accepted, so axiomatic, if I may be permitted to use that term, that the individual differences may be passed over as unimportant.

My brother kneeleth,—saith Kabir,
To brass and stone in heathen wise.
But in my brother's voice I hear
My own unanswered agonies.
His God is as his fates assign;
His prayer is all the world's,—and mine.
KIPLING.

Pantheist, theist, deist, Christian, Buddhist, or Mohammedan,—all have at least two common factors, namely,—the assumption of, or belief in, some concept of a Higher Power or Mind over and above the

material universe, combined with a personal effort to put one's self in tune with the subjective picture of what is conceived to be the plan, wish, or will of this super-cosmic entity.

It would be possible (and easy) to state at this point that science needs no definition, yet, strangely enough, our definition of science is by no means so ready and instant as it was half a century ago. We recall the older and somewhat limited view-point of the orthodox scientist;—his was the lore of things heard, seen, and felt. He refused to admit into his data anything which could not be tested by his measuring rods. These measuring rods were, and still are, of many kinds;—the scales, thermometers, and electrical conductors of the physicist, the reagents and combinations of the chemist, the astronomer's telescope, the biologist's classifications and laws of inheritance, his microscopes and stains, the reaction machines and mouse-mazes of the psychologist, the statistical laws used by the investigator in political science or anthropology, and many others.

It is my contention that such a definition of science is faulty; that modern science must have a more prominent place for relationships. It may be that relations between things are the only real and certain facts of the universe. The ultimate analysis of what we term number, say the number 2, is full of philosophical difficulties; we may, however, define a certain process called multiplication, and multiply this thing called 2 by another thing of the same sort. We have made some laws of our own to do this, yet these laws, if we observe them, are very real things.

Science has always permitted itself, nay, demanded,

the right to make deductions and formulate laws, yet the older science placed very definite limits on the process. It cheerfully admitted two entities of the sort that could be treated with its measuring rods, and deduced a law connecting the one with the other. An entity of any other sort was denied. Before a fact or entity which seemed to stand by itself, with no other similar fact or entity in some sort of relation before it, science threw up its hands. We may put this more clearly by a familiar illustration. There seems no doubt that there is a something which we call the universe. It is filled with matter which in its microscopic aspects: nebulae, suns, galaxies, is of remarkable simplicity and uniformity. One little section of it is filled with matter and facts of the utmost intricacy and complexity;—the mystery of life;—what Conklin has termed the “diabolical ingenuity” of that same life to provide that a male and a female element may meet and keep life going; the mystery of thought and what we term originality, that creative element in man which makes new combinations and new substances.

These greater facts are vastly more important, as well as vastly more difficult than the number of chromosomes in a cell or the temperature relations of a cooling alloy. Must science, as in the past, refuse absolutely to have anything to do with the consideration of these greater facts, and simply lump them as unknowable? In other words, must science refuse to apply reason and analysis to data which seem self-sufficient and without antecedent explanatory data? We call such a process speculation, yet it would seem that a moderate amount of speculation

should be a good thing for a scientist; to paraphrase Mark Twain, it will keep him interested and prevent him from brooding over being a scientist.

I personally prefer another definition for science. Science is the body of things known, with the attempt to arrange *all* things in *orderly* fashion. The important words are italicized with intent. The first one indicates that science need place *no limit whatever* on its attempts to explain things. Under this ruling, the speculations of religionists and philosophers regarding a First Cause are a form of science. Many of these may be wrong, as have been many scientific theories relating to more mundane data. Secondly, my cosmos *must* be orderly; I must have connections uniting the totality of data in what we term order. I care little how we shall define "order"; whether we call it cause and effect, sequential harmony, or the concept of purpose and end. Neither do I worry lest this "order" I am attempting to postulate for the universe is simply a projection outward into the universe of my own laws of thought, and a conceivably fallacious analogy with entirely unallied developmental gamuts. I have no other process, and this must serve. As will be illustrated later, modern science, in spite of itself, is beginning to admit here and there, the formerly distrusted and hated element of hypothesis. In order to avoid that doubtful word, "hypothesis," or its brother, "speculation," it is quite usual to substitute the more innocuous and apparently more scientific phrase,—*"scientific inference."* Scientific inference, a deductive method, is of wide and valid use, yet when we use it to the limit, the boundaries between it and pure hypothesis are vague and ill-defined.

Newton, that keen reasoner and careful investigator, whom most of us still regard as the most powerful intellect which has yet appeared on this earth, seems never to have been moved by the plebeian faults of pride or vain-glory in his scientific work, even though occasionally human in his religious controversies. Yet we can almost imagine that this Titan felt a touch of human pride and self-appreciation as he penned the words,—“*Hypotheses non fingo*,”—“As for hypotheses, I don’t make them.” And later, in his *Opticks*: “The main business of Natural Philosophy is to argue from Phænomena without feigning Hypotheses, and to deduce Causes from Effects, till we come to the very first Cause, which certainly is not mechanical.” Basically, and with due regard for the results from more modern theories of knowledge, it seems certain that Newton told less than the truth in his complacent rejection of hypothesis. He thought that he was not making them, while as a matter of fact his deductions, his mathematical equations, his very laws of thought, go back to hypotheses of one sort or another, either just beneath the surface, or deeply hidden in the sub-structure of mind. He founded a wonderful mechanism on a few assumed axioms, but an axiom is merely an hypothesis which *ought* to be true. Quite a proportion of present-day scientists are now seriously considering a radically different hypothesis of the structure of the universe from that of Newton,—the theory of relativity. It is perhaps too soon to try to make a prophecy as to whether Newton’s gravitational universe, or a relativity universe with time and space united in a single unit and with gravitation thrown out entirely as a dis-

tinct force, or some other as yet undreamed-of explanation, will be what the scientists of a century hence will teach as the law and the gospel.

As we look back over the discarded scientific theories of the past, once regarded as inspired and now only of historical interest, we are more and more forced to the conclusion that in the final analysis any scientific theory is simply a belief. We believe the present atomic theory instead of the theory of the indivisible and unchanging atom of forty years ago because it seems to our intellects that it explains more things than did the old hypothesis. As we analyze our acceptance of the last, or the next to the last, of the three successive atomic theories of the past decade or so, there are few scientists, not even the respective authors of the theories themselves, who would be so opinionated as to presume an infinite life for these theories. We feel quite sure, from the experience of the past, that these in their turn will be displaced by other hypotheses, and make their way to the limbo of discarded beliefs. Most of us are inclined to believe that it is a good thing that the absolute authority once assigned to clerical interpreters of theological systems has in a large measure passed. It is a distinct advantage to science that it now realizes that it can have no hierarchy to issue infallible and inerrant pronouncements.

Libraries are filled with the pleasant or unpleasant certainties of this or that man-made creed. We recall those forefathers of ours of that strong northern clan whose joy has always been hard, stern, and complicated thinking, we remember their limitations of

correctness to but a few, their rigid rejection of all outside their small flocks. It is almost two hundred years ago that Jonathan Edwards, at Northampton, Massachusetts, preached his famous sermon,—“Sinners in the Hands of an Angry God,” painting hell-fire with such eloquence and power that his hearers gripped the pew backs in agonies of religious ecstasy, as they consigned nearly all people on earth to perdition. He gave this sermon nearly one hundred times, it is said, and always read it from manuscript, perhaps to be sure that he would not improvise on so vital a theme. It was Edwards, too, later president of Princeton, who gave from his pulpit the kindly pronouncement:

As innocent as young children seem to be to us, yet if they are out of Christ they are in God’s sight young vipers, and infinitely more hateful than vipers.

And, one hundred fifty years later than Edwards, the laws of the science of that date seemed so sure, so divinely ordained, so to speak, that all authority rested in them, and it was felt that we were here and there coming quite close to the real boundaries in all aspects of nature. It was a scientist who proved the impossibility of a steamship crossing the Atlantic under its own power; scientists assigned a few paltry million years for the past and future duration of the sun; scientists gave us what Chesterton feelingly refers to as “the dear old atom,” and the immutability of matter. It is not so much the subject matter of the scientific gifts of that now almost prehistoric age which causes a slight scientific blush for the tribe in general, as was the mental attitude accompanying the

gifts. That older and more intolerant science has suffered many a hard knock and disillusionment during the past two decades, and this forced abandonment of tenets formerly taught as inerrant and inspired has had a most salutary effect. We recall the famous words of the Virginian, when a well-known biological impossibility was attributed to his pedigree,—"Stranger, when you call me that, *smile*." It is not a bad thing that present-day scientists, or at least the older members of the group, have learned to smile a little.

For we are not quite so cocksure now; we older men in the physical sciences have had to change our creeds several times in the relatively short span covered by our scientific activity, and we now realize that our present theories, while they are the best that we can now derive from existing observational data, may conceivably be changed over night by new experimental evidence, or by the analysis of some desk-worker who knows no apparatus, but works in that world of the spirit which we call mathematics.

Thus it is that we find to-day that both religion and science are relatively chastened and humbled schemes of thought as compared with the autocracy, the self-sufficiency, the self-esteem, and the arrogance which they both have displayed in the centuries past. The pot can not call the kettle black.

Philosophy, having already made a helpful alliance with mathematical science, is now more and more demanding notice from the physicist. We are coming to realize that some of the age-old laws of thought are more applicable to physical theory than had formerly been dreamed. Our modern atom apparently does

not inflexibly obey some definite law of motion; all we can say of it is that there is a probability, amounting almost to a certainty, that it will occupy a certain realm at a certain time under certain given conditions. Perhaps, in the final analysis, our electrons within the atom, our molecules in a gas, our populations covered by life insurance, all obey as their only fixed law the law of probability. These, which have sometimes been called the laws of uncertainty, may possibly be the only certain things in physical theory.

I stated at the beginning that my subject would be restricted to religion in its general or absolute sense. In certain oriental pantheons there are literally millions of gods; gods in such profusion and richness that a separate god could be assigned to every conceivable function of life or thought. It would seem inevitable that in such rich pantheons there must be at least one minor deity under whose special protection are placed those who write, and that just as certain deities have been made tutelary for sailors, farmers, women, and soldiers, there must be one to look after writers, legislators and the like. It would seem that in the eyes of such a tutelary deity the one unpardonable sin would be not sticking to one's subject. I would, therefore, at this point pour a libation to this unknown forensic deity, this θεὸς ἀγνοστος of those who use the pen, that I may avoid the sin of wandering from the issue.

For the past and present peculiarities of creeds or scientific theories alike have nothing to do with the subject. If our subject is enlarged so as to include the influence of modern physical science on this or that

minor credal belief, or the changes which have been brought about in this or that body of religionists, the theme would at once become so vast that a good-sized library would be necessary for the enumeration of the details. It is a grave error to lay any emphasis whatever on such unimportant credal changes; there is danger that we do not see the forest for the trees. As illustrations of changes in such minor points we have only to compare with modern concepts the older ideas of creation, inerrancy and inspiration of records of faith and the universal applicability of minute and particular credal pronouncements.

It is an error, also, to attribute the sum total of such changes to the influence of science; some of it is due to this cause, but by no means all. Simply because science has had its development in a parallel course during the past five hundred years does not mean that this has been the only active agent. We must give a high weight, perhaps equal weight, to thousands of other tendencies and influences, some of which have arisen within the various churches and beliefs themselves, while others have been motivated by parallel evolutionary developments in philosophy, ethics, government, education, or in the vast field of general human relationships.

In the belief that changes or errors in creeds, religious tenets, or even the theories of science, do not come under my subject at all and are in no way germane to the discussion, I will summarize by laying down the following proposition, even though it may seem an over-statement of the problem to some: *Religion, in its absolute sense, has not changed an iota because of the results of modern physical science, ex-*

cept in so far as it has been rendered a no less probable belief.

The various components of this assertion will need some elaboration. I have already sufficiently outlined my concept or definition of what I consider the basic axiom of a religious belief or religious code of life. This infinite concept has not changed essentially during the past few millenniums any more than have any other of the infinite concepts against whose barriers the finite mind of man must admit defeat;—such concepts as eternity or limitless space. The idea of God in Akhenaton's psalm of 1400 B.C., in Micah's rule of religion, in the Sermon on the Mount, is essentially identical with the religious attitude of men of to-day. The concept of God has become nobler as man himself has developed nobleness. But as a concept, as a norm of belief and conduct, and however wide the difference in the minutiae of the belief, there is an essential identity between the strange gods of the savage and the monotheism of those peoples which have attained the highest development.

The thesis that modern physical science has had no effect on religious belief except in so far as it has rendered it a no less probable belief is doubtless not capable of rigorous treatment. The reasons adduced for a belief in a higher power are to-day just what they were five thousand years ago. A great deal has been subtracted by science from two of these arguments; a vastly greater amount has been added by the same progress of science to the third.

For two of the arguments advanced by the theologians or philosophers of old are arguments whose validity has been seriously shaken, partly by science,

partly by other forces. The first of these is the argument adduced from the universality of religious belief among practically all people and all races. It is not a scientific argument. For it is quite possible to imagine a world in which all intelligent people hold unanimously to an incorrect faith. Majorities are always only probably right. Convictions, otherwise called faiths, have led, it is true, to astonishing and inexplicable results among all peoples. The Tibetan monk who joyfully allows himself to be walled up in a small cell to spend the rest of his life in darkness in a cruel climate, the tortured Hindoo fakir, the Australian aborigine with his terrible and race-destroying self-mutilation, the Christian martyr, the Mohammedan saint, all are remarkable and to some degree inexplicable phenomena. They are, however, not convincing as scientific arguments.

With all our admiration for the beauty and the inspiration—I use that term designedly—of the various scriptures of the world, and assigning to them all possible weight as manifestations of the universality of religious belief, these can not be classed as evidence in the scientific sense. The Puranas, the precepts of Confucius, the Bible, the Avesta, the Koran, are remarkable and wonderful documents, but not scientific proofs.

After all is said and done, the only scientific argument that has any weight to-day is one which has appeared in various forms for at least three thousand years, and is based upon the universe itself. At best, it is an argument from analogy or probability, yet not unlike certain physical assumptions or theories in its

basal elements, and possessing at least the same logical value. It is not necessarily the old argument from design, for the assumption of elements of design or plan in a universe may conceivably be the projection outward of the design elements of our brains and laws of thought, just as a prism of glass from the method of its construction, forces an orderly sequence of wavelengths to be assumed in the incident beam of confused and tangled vibrations. This argument, based on analogy, from the majesty of the universe itself, and requiring a supreme mind as a necessity in a universe which contains both mind and matter, and in which we already have an apparently infinite element of matter, is to-day stronger than it ever was, simply because we know more.

All of which leads naturally to the essential point of this paper: *what limit does modern science place upon the formulation of beliefs, either in its own field or in the field of the spirit.* There is manifestly a tremendous gradation in the beliefs which science now holds. The distance traversed by a body falling toward the earth increases with the square of the time of fall. We can test this out; if we think that the resistance of the air changes our derived law, we can either imagine the air removed, or actually try the experiment in a vacuum. But even in so simple a physical experiment, the hypotheses or beliefs which we must call in, stretch out to infinity. One of at least two beliefs must be assumed, either of which is as arbitrary in certain respects as is the postulation of infinite time, space, or power. The older and usual assumption is that there is a mysterious and all-pervading force called gravitation. We derive certain

rules which we call laws for this force, which is all-pervading. It is so minute a force that we cannot experiment with it, for it is smaller than electrical attraction by the factor one followed by forty-one ciphers. It obeys the inverse square law, and when we have said that we have finished; our main reason for believing in it is that we have to have something. At the risk of insulting the reader's acumen, I must call to his attention here the essential peculiarity of this assumption. We had certain facts; it was necessary to explain them; so gravitation was assumed; quite easy! Is the assumption of a First Cause by the religionist any less logical?

The second and modern alternative hypothesis is that there is no such force as gravitation. The universe is supposed to be built on a strange four-dimensional basis which is so transcendental—in the mathematical use of the word—that it is impossible for our three-dimensional minds to make any picture of it. In this strange and transcendental universe, space is curved wherever there is matter; hence things roll down to the earth in this curved space because they can not help doing so any more than a ball at the outer edge of a wash basin can help rolling to the bottom of the basin.

Let me at this point, as promised earlier, consider two illustrations of the liberty of speculation which modern science is forced to assume. This new attitude, observed with sanity, is highly commendatory, and indicates some measure of rapprochement with philosophy and religion, at least in method.

Our first illustration may be derived from modern atomic theories. This was preceded by a stage, rep-

resented in part by Bohr's theory, in which the attempt was made to construct an actual mechanical model of electrons moving with tremendous speeds about a central nucleus; such a model was for a time satisfactory in explaining the various vibrations emitted in the spectrum. This has now been largely abandoned; the former mechanical models have been replaced by transcendental mathematical abstractions, where probability relations rule supreme. We no longer say that an atom will do a certain definite thing at a specified time and under specified conditions, but that there is a certain probability that it will do this thing. We give up attempts to picture the atom; we assume forces of unknown action; in effect, we postulate some *deus ex machina*; in short, we consider ourselves permitted to indulge in some measure of speculation. The suggestion has even been made that the laws governing the atom are of such a super-material character that they are unknowable by man's present intellect. Exactly the same type of argument has been used with regard to man's concept of a Deity!

I happen just now to be writing an astronomical treatise, and in that process I find that I must discuss two different theories of an infinite universe, around which subject there has already grown up a very extensive literature. These two alternative theories are based to some extent upon what our telescopes show, but for the most part upon mathematical reasoning. Now a scientist is certainly allowing himself a great deal of liberty when he seriously considers hypotheses of so tremendously speculative a nature. We shall have to admit that infinity is a large word! My tele-

scopes do not reach to infinity; I cannot go out to the distance of the farthest thing I see, which, in miles, is roughly the figure one followed by twenty-two ciphers, and then prove that the universe goes on at least as far again from there.

I am accepting in my mind one of these two alternative theories of an infinite universe, just because it seems to me more probable than the other, and I believe in it because it seems more reasonable to me, whatever that term "reasonable" may mean in a final analysis. Am I reasoning from analogy or probability in considering either one of these infinite theories? Most certainly. As a matter of fact, nearly every argument which has been advanced against the theological acceptance of God from the majesty of the universe or from its elements of design and purpose might equally well be urged against either of these two scientific theories.

Now have I any right as a scientist to speculate on such tremendous questions? I feel that I have, and that similar speculations by philosophers or theologians are likewise quite worth while and just exactly as scientific. With a pure agnostic who tells me that I can never prove either hypothesis of an infinite universe, I must instantly agree; I must admit at once that my mind cannot conceive anything that is infinite, and that the language of mathematics becomes indeterminate there. It is self-evident that I cannot *prove* which theory of an infinite universe is the better one or the more true; there are admittedly a large number of assumptions in the thought that it is infinite at all, even though it is just as difficult to think of a finite universe as an infinite.

But I demand the right, as a scientist, to make such theories. In the absolute sense, science can be limited only by the universe itself. Pure agnosticism is a dead and stagnant thing. I am perfectly willing to admit that no knowledge of things either finite or infinite can be absolutely complete and final. No such considerations, however, can prevent me, as scientist, from employing such methods of observation and reasoning powers, even if the latter must border on speculation, in attempts to formulate a theory of things as a whole.

The truth is that science, although it will not always make a free admission of the fact, is in every field making speculations, or holding to beliefs as working hypotheses. From the behavior of a falling body to the theory of an infinite universe is a far cry. That in either case we eventually come up against some sort of an immovable obstacle is perhaps just a natural consequence of the infinite character and infinite complexity of the physical world. I refuse to permit any irrelevant lack of finality to prevent me from thinking.

Can science grant a similar freedom of thought to the philosopher or the religionist working in the world of the spirit? Science certainly has no right to refuse to others the privileges which it is constantly implicitly assuming for itself. In the final analysis, my acceptance of one or another theory relating to the infinite concept of a universe without limit is not at all different from the reasoning of a philosopher as to a First Cause or that of a religionist with regard to God. To the religionist, however, who announces his theory as definite, final, inevitable, inspired, the scientist promptly sounds a warning. He demands from him the same humility and modesty which the hard expe-

rience of past decades has forced upon science. Your theory of a divine Higher Power, says the reverent scientist to the religionist, is highly probable. It forms the easiest, best and most probable way of explaining all the facts which I observe in this strange universe in which my mind finds itself placed for a few years. It is a belief, like my present belief in the latest atomic theory. I very much doubt, says the scientist, whether we are ever going to know every last thing about what goes on inside of an atom. Man's idea of the atom has been changing for centuries; there has been a similar change and evolution through the ages in man's idea of God. If you say that your belief in God is final and fixed, that your religious creed is inspired of him, and that no other belief is true, then I shall be offended and refuse to follow you because you are unscientific.

I often think that the old theological philosophers who divided man's nature into body, mind, and spirit were not so far wrong, whatever may be the road into which modern psychology is trying to lead us. That strange thing, the spirit of man, which creates things unknown before, which controls ordinary matter, which does so many things that seem inexplicable on any mechanical theory of behaviorism, is another field than that of science, except in the fact that it inspires science. No theory of the universe can be complete until this element is included.

A recognition of this non-physical world of the spirit seems to be becoming more usual in modern science. That interesting and able Quaker, Eddington, has written a scientific best-seller called *The Nature of the Physical World*. Some of the chapters

coming first in this book are difficult reading. Even if they are true, they are not particularly interesting, and I am one who finds difficulty in believing that all of the pronouncements in this early portion of the book are true. By and large, however, it is an epoch-making book. One should read it in the manner popularly supposed to be distinctly and peculiarly feminine, by reading the last few chapters first. May I quote from the beginning of the last chapter?

One day I happened to be occupied with the subject of "Generation of Waves by Wind." I took down the standard treatise on hydrodynamics, and under that heading I read,

"The equations (12) and (13) of the preceding article enable us to examine a related question of some interest, viz. the maintenance of waves against viscosity, by suitable forces applied to the surface."

[Here there follow some complicated and intricate mathematical equations.]

And so on for two pages. At the end it is made clear that a wind of less than half a mile an hour will leave the surface unruffled. . . . At two miles an hour the gravity waves appear. As the author modestly concludes, "Our theoretical investigations give considerable insight into the incipient stages of wave-formation."

On another occasion the same subject of "Generation of Waves by Wind" was in my mind; but this time another book was more appropriate, and I read,—

"There are waters blown by changing winds to laughter
And lit by the rich skies, all day. And after,
Frost, with a gesture, stays the waves that dance
And wandering loveliness. He leaves a white
Unbroken glory, a gathered radiance,
A width, a shining peace, under the night."

The magic words bring back the scene. Again we feel Nature drawing close to us, uniting with us, till we are filled with

the gladness of the waves dancing in the sunshine, with the awe of the moonlight on the frozen lake. These were not moments when we fell below ourselves. We do not look back on them and say, "It was disgraceful for a man with six sober senses and a scientific understanding to let himself be deluded in this way. I will take Lamb's *Hydrodynamics* with me next time. It is good that there should be such moments for us. *Life would be stunted and narrow if we could feel no significance in the world around us beyond that which can be weighed and measured with tools of the physicist or described by the metrical symbols of the mathematician.*" [Italics added by the present writer.]

And again, in the next to the last chapter in the book:

The cleavage between the scientific and the extra-scientific domain of experience is, I believe, not a cleavage between the concrete and the transcendental but between the metrical and the non-metrical. . . . The recent tendencies of science do, I believe, take us to an eminence from which we can look down into the deep waters of philosophy; and if I rashly plunge into them, it is not because I had confidence in my powers of swimming, but to try to show that the water is really deep.

In conclusion, what then are the relations of the modern physical sciences to religion? There seems but one answer. Let us forget for the moment the changes which have taken place in churches and creeds as distinguished from our basic concepts of religion and of a religious life. These have nothing to do with the subject. Many of these changed points of view as to the literal inerrancy of sacred records have been due to scientific knowledge gradually acquired. Yet many or all of these changes would have come anyway, more slowly perhaps, but eventually.

There was a time when scientists looked confidently to a theory of pure mechanism, with mind, body and

soul the result of chemical and physical actions, and for a time this tendency promised to destroy religion, root and branch. This now seems far less probable than it did forty years ago. The most wonderful phenomenon of one's experience in this supremely wonderful universe is mind and personality, directing, controlling, creating. Even the evidences of purpose or end and gradual development in this universe are not more astonishing. No theory of this cosmos can be adequate which does not give some theory or hypothesis for the occurrence of these two remarkable factors. I personally can conceive no hypothesis for all this which seems so simple and satisfactory, so adequate, so in accord with existing methods of scientific inference, as those conclusions which we commonly term religion.

Now in such a religion of a scientist, a religion which reasons merely from analogy or probability, it is true, but a religion whose strongest argument comes from the infinite complexity of the whole and its apparently infinite size and grandeur, the more one knows, the more accurate will be one's appreciation and acceptance, whatever may be the ultimate decision as to the validity either of the known facts, the deduced laws, or the reasoning processes involved. Just as my cosmos is infinitely more complex and more wonderful than that of the ancient Hebrew, so much the more true and convincing is my appreciation because it is based upon a knowledge which is more complete. In this light, the increased knowledge of the physical universe which has been given by modern science must be regarded as the main inspiration and support of a sane and reasoned religious belief.

A BIOLOGIST'S RELIGION

EDWIN G. CONKLIN

EDWIN GRANT CONKLIN was born in Waldo, Ohio, in 1863. He holds degrees from Ohio Wesleyan University, Johns Hopkins University, the University of Pennsylvania and Western Reserve University. From 1891 to 1894 he was Professor of Biology at Ohio Wesleyan. Then he taught successively at Northwestern and the University of Pennsylvania. Since 1908 he has been at Princeton; and is now Professor of Biology at that university. He is a member of many societies organized to promote the natural sciences in this country and in Europe. He has written widely, with such subjects as, *Heredity and Environment*, *Mechanism of Evolution*, *Science and the Faith of the Modern*, *The Future of Evolution*, *The Revolt Against Darwin*, *Biology and Democracy*, and so on. Dr. Conklin is one of the best known biologists of our time.



V

A BIOLOGIST'S RELIGION

By EDWIN G. CONKLIN

THE age-old conflict between conservatism and radicalism, or, as the biologists express it, between heredity and variation, has become quite prominent in this post-war period of rapid change, or of biological mutation. In the main, religion represents the conservative element in human society, science the radical element, and it is not surprising that these two mental attitudes are often in conflict.

Strictly speaking, there is and can be, no conflict between science and religion for they deal with different universes. Science is classified knowledge based on sense impressions and rational processes; its methods are observation, experiment, generalization; and its aim is to understand, that is to classify, and to control natural phenomena.

Religion, according to the *Century Dictionary*, is faith in, and allegiance to, a superhuman power or powers. Whether such powers be regarded as natural or supernatural, personal or impersonal, varies with different religions. It is based largely on subjective feelings, instincts, needs, and on objective revelations. Its aims are faith, hope, love and more perfect ideals, aspirations and harmony of life.

CONFLICT BETWEEN FUNDAMENTALISM AND MODERNISM

Between science and religion as so defined and understood there is and can be no more conflict than between intellect and emotion, or science and art. But between the conservative and the radical type of mind, between the theologian and the scientist there often is conflict. The conflict between fundamentalism and modernism centers largely in the nature, origin and purpose of the Bible. The conflicts between theology and the natural sciences have been caused in large part by the doctrine that the Bible is a divine revelation regarding nature as well as religion.

These conflicts in the past have involved the science of astronomy with its teachings as to the position and movements of the earth and planets in the solar system; with meteorology as to the causes of seasons, winds, rain, lightning, the rainbow, etc.; with geology concerning the age of the earth, the meaning of fossils, catastrophism versus uniformitarianism. But the most serious of all these conflicts have been over the teachings of biology regarding the germinal origin of the individual, the natural origin of species, the nature of life and the nature and origin of man. Many Christians believe that biology is the Judas among the sciences; all the sciences may have forsaken their Lord, but biology has betrayed him.

THE OLD COSMOGONY AND THEOLOGY

Let us in a sympathetic and constructive spirit try to understand both sides of the age-old controversy between conservatism and radicalism; between fundamentalism and modernism. The old cosmogony, phi-

losophy and theology placed man at the center of the universe; for him all other things existed. The earth was the center of the celestial sphere; the sun, moon and stars were created to give light to man, and all living things were created to minister to him.

Man himself was created in the image of God, perfect and immortal, and although by his first disobedience he

Brought death into the world and all our woe
still his soul remained immortal and he waited in
hope

'Til one Greater Man restore us and regain that blissful seat.

Thus the whole history of the human race ran from Paradise Lost to Paradise Regained, from perfection to perfection. There was enormous satisfaction in this view of the universe and of man, and there was also in it great stimulus to efforts for betterment.

THE NEW COSMOGONY OF SCIENCE

It is now generally recognized that these beliefs regarding the central position of the earth and of man in all the universe belong to the childhood age of the race and of the individual, and it is becoming increasingly evident that these traditional views as to the nature and origin of man and the anthropomorphic conception of God and of his governance of the universe, also belong to the philosophy and theology of childhood. No longer is it possible to think that man was created perfect in body, mind or morals, or that in physical form he is the image of God. No longer is it possible to think of God as "the Good Man" or

the Devil as "the Bad Man." No longer is it possible to regard miracles—in the sense of suspension or violation of natural law—as of daily occurrence, nor magic as the universal means of controlling nature or supernatural powers. To persons of mature mind this faith of childhood is gone and gone forever.

LOSS OF RELIGIOUS FAITH

The first effect of loss of childhood faith is universal disbelief in everything that is incapable of scientific proof. One of the most dramatic moments of my college days was when a Senior, who was generally regarded as the best student in college, was reluctantly persuaded by classmates to rise in a great religious meeting in the Chapel and confess his loss of religious faith. He told of the faith his mother had taught him and then said, "I studied astronomy and geology and biology; and the Bible story was gone. I studied psychology, philosophy and religion; and free-will, immortality, and God were gone."

This experience has been duplicated by many earnest, serious students. The reaction against the untenable faith of childhood has carried them to the other extreme of no religious faith at all. I recall a conversation I once had with a great biologist, who, in a sort of frenzy, recited his creed of unbelief: "There is no God, no Devil, no heaven, no hell, no plan or purpose in the universe, no soul, no immortality, no free will, no responsibility." And at another time he added this inevitable conclusion to such a creed: "The evolution of consciousness was the greatest blunder in the universe," meaning that if only we had remained unconscious it would not have mattered

that there is no plan in nature and that death ends all for the individual and the race.

Such a philosophy of despair is not confined to scientists but is found among all those who see in human life only aimless suffering and evil with no faith in progress and no hope for the future. Even genial and lovable Mark Twain could write :

A myriad of men are born; they labor and sweat and struggle for bread; they squabble and scold and fight; they scramble for little mean advantages over each other. Age creeps upon them; infirmities follow; shames and humiliations bring down their prides and their vanities. Those they love are taken from them, and the joy of life is turned to aching grief. The burden of pain, care, misery, grows heavier year by year. At length ambition is dead; pride is dead; vanity is dead; longing for release is in their place. It comes at last—the only unpoisoned gift earth ever had for them—and they vanish from a world where they were of no consequence; where they achieved nothing; where they were a mistake and a failure and a foolishness; where they have left no sign that they have existed—a world which will lament them for a day and forget them forever. Then another myriad takes their place, and copies all they did, and goes along the same profitless road, and vanishes as they vanished—to make room for another and another and a million more myriads to follow the same arid path through the same desert and accomplish what the first myriad, and all the myriads that came after it, accomplished—nothing.

And yet, neither Mark Twain nor any other philosopher of despair could avoid the instinct to work for human betterment. The deeper currents of their lives run counter to these eddies on the surface. Laborious days and thoughtful nights reveal their faith in human work and worth and progress, and their despair indicates only their discontent that progress is so slow.

If there is no plan or purpose in the universe or in human life, if extinction is the goal toward which we as individuals and a race are inevitably driven, one may well say, "What is the use of efforts for improvement of the individual or the race? What is the use of education, eugenics, ethics, religion? What is the use of science, of discovery, of invention? What is the use of anything? Nothing." Utter pessimism is the outcome of such beliefs, and Nirvana is the only boon.

It is impossible to live such a philosophy of negation, a philosophy of despair and suicide, rather than of hope and life. Surely there must be something wrong with any philosophy that cannot be lived. It may be logical but it is not inevitable. After all, logic is not an infallible guide to truth; and carrying a process of thought to its "logical conclusion" has often ended in evident absurdities. The logic of events is a better guide to truth than the logic of syllogisms. There is at least some truth in the contrast between physics and metaphysics made by the late Professor Rowland. "In metaphysics," he said, "when a man has constructed in thought a logical and unified system, he publishes it as his system of philosophy, but in physics after one has formulated his logical system he tries it out in the laboratory and nine times out of ten finds that it is not true." In science the test of truth is not logic but appeal to fact, and similarly in philosophy and religion the practical test of truth is not logic but livability. Surely there must be something wrong with a philosophy that ends only in a slough of despond. Surely inevitable and universal

extinction cannot be the goal of a thousand million years of evolution.

Contemplate all this work of time,
This giant laboring in his youth,
Nor dream that human love and truth
Are dying nature's earth and lime.

RATIONALISM NOT AT FAULT

Let us go back and see where we took the trail that led to this slough of despond. Certainly not in following the light of reason in dealing with these great problems, for although we may, with Darwin, doubt whether the mind of man can be trusted when it draws such grand conclusions, it is not reasoning itself that is at fault but poor reasoning. This is the faculty which, more than any other, distinguishes man from all other creatures, it is, in the words of a modern heretic, Robert Ingersoll, "but a feeble flame by stumblers carried in a starless night, and yet it is our only light." Even revelation must be interpreted by reason, and those who advise us in the interests of preserving our childhood's faith to "take our reason captive" are counselling what is not only impossible but positively irreligious for we are commanded to "worship the Lord our God with all our mind." Charles Kingsley once said: "The God who satisfies our conscience ought more or less to satisfy our reason also. . . . For the demands of reason, as none knew better than good Bishop Butler, must be and ought to be satisfied." Will any fundamentalist maintain that we alone of all living creatures were given reason to deceive us and to lure us to destruction? The old warcry against rationalism will no longer avail; we will not be fright-

ened by names. No, we have not strayed from the highway of truth into this morass by following sound reason, but evidently by faulty mental processes that will not bear the test of actual experience. The only remedy and substitute for poor reasoning is better reasoning and not its total elimination.

SCIENCE NOT RESPONSIBLE

We have not departed from the highway of truth by accepting the teachings of natural science regarding the immensity of nature and the smallness of man. The sciences of astronomy, geology and biology have so enormously enlarged our views of the universe that space and time have become practically infinite and the days of creation have become billions of years. This enlargement of nature has led to a corresponding shrinkage of man when measured by standards of space and time, but when measured by reason, conscience, aspirations, it is a different story. For the first time in the long history of life on this planet there has appeared in man a being capable, to a certain extent, of understanding and measuring this wonderful universe and of controlling some of its processes. By this measure man is not an insignificant creature. Isaac Watts expressed this well when he wrote:

Were I so tall to reach the pole,
Or grasp the ocean with my span,
I must be measured by my soul;
The mind's the standard of the man.

And the Psalmist expressed it still better when he said:

When I consider thy heavens, the work of thy fingers, the moon and the stars, which thou hast ordained; what is man

that thou art mindful of him? and the son of man that thou visitest him?

Thou hast made him a little lower than the angels, and hast crowned him with glory and honor. Thou madest him to have dominion over the work of thy hands; thou hast put all things under his feet.

The magnitude of the universe has not dwarfed the soul and mind of man.

EVOLUTION NOT TO BLAME

The teachings of biology as to the animal ancestry of man, or as to his development from germ cells, has not degraded man and produced this utter pessimism. Lowly origin is not incompatible with ultimate greatness, as none know better than the countrymen of Washington, Franklin, Lincoln and Grant. All the greatest leaders of men were once babies and germ cells and yet this humble origin does not preclude a glorious destiny. It was odd to read William Jennings Bryan's strenuous objection to this democratic doctrine. The real dignity of man consists not in his origin but in what he is and in what he may become. The degradation of man consists not in evolution and development but in the reversal of this process. We could sympathize with Mr. Bryan's outcry: "No one shall make a monkey of me!"; and we would equally sympathize with the phrase, "No one shall make a baby of me!"; because this would be a reversal of progress and development. Evolution and development have not degraded man. Nature and human history proclaim the fact with delight that supreme greatness may have humble origins.

Evolution deals only with process and does not

touch the question of ultimate causation. What lies back of evolution no one knows. The atheist sees only mechanism and accident without other design or purpose than is found in this mechanism, which is really his *deus in machina*. The theist sees back of the whole process divine power and plan. The Christian sees a Heavenly Father. Science cannot deal with this mystery; it is a matter of faith alone; but it is plain that Christian faith gives the largest value to human life and the greatest stimulus and comfort.

NATURAL LAW NOT RESPONSIBLE

It was objected to Newton's law of gravity that it drove God out of his universe and put a law in his place. This same objection has been made by many opponents of the laws of development and evolution; and yet a natural law is only a stated, fixed, settled method or process, and surely there is no more evidence of divine power in a chaotic and capricious universe than in an orderly and lawful one. On the other hand if the universe were a chaos instead of a cosmos it might be taken to mean that there is no God and that everything is the result of chance. The very existence of order seems to imply some other governance than chance.

These same considerations apply to human life and activity as well as to the outside world. There is no good reason for supposing that lawlessness and caprice and chance are any better evidences of wisdom or power or freedom in man and society than in the universe at large. The determinism of science is not pre-determinism or fatalism, and when applied to man it is clear that it does not destroy all freedom and re-

sponsibility. As a matter of fact, we know that our wills are not perfectly free. Heredity and early environment have set bounds about us that we may not pass; but within those bounds we have a certain amount of freedom. We are partly free and partly bound. Within certain limits we may choose between alternatives that are open to us and may be held responsible for making right choices, but we cannot directly make the alternatives or always choose between them when they are offered. In short, human freedom and responsibility are relative and not absolute, and the truth of this is recognized by all civilized societies. The concept of universal law as applied to the world, to the individual or to society, does not, when properly understood, destroy faith in God, nor human freedom and responsibility.

CAUSES OF UNBELIEF

The real causes of loss of religious faith on the part of many scientists and scholars are to be found primarily in a revolt against ecclesiasticism, literalism, formalism; and against an insistence upon the faith of childhood as contrasted with the results of science. If representatives of religion insist upon these as the essentials of religious faith then scientists and scholars generally will be unbelievers.

Other causes are found in the error that anything is "explained" when it is reduced to a principle or law, and that a law or principle is itself a cause; that law and mechanism require no explanation; that a scientific analysis is ever complete, and that there are no unknown factors in such analyses; that there are no phenomena in the universe which cannot be sub-

jected to present methods of scientific inquiry; that scientific determinism is fatalism.

Perhaps more than anything else unbelief and pessimism are caused by the thought that there is no plan or purpose in the universe and that everything is the result of chance and accident. Undoubtedly chance has played a large part in the evolution of worlds and of organisms, but I cannot believe that it has played the only part. Chance has determined many things in our individual lives, but nevertheless our lives are not purposeless. There are ends and aims in the life of an amœba or in one of our blood corpuscles, and much more in our conscious lives. I cannot understand how any one can take the long view of nature that science reveals, can follow the course of evolution from the formation of atoms to the development of man and consciousness, and still believe that it is all without plan or purpose. It seems to me much more probable that matter, energy, life and mind,—that the principles, laws and, in general, the order of nature are evidences of the immanence of some plan in this universal mechanism which we call "nature."

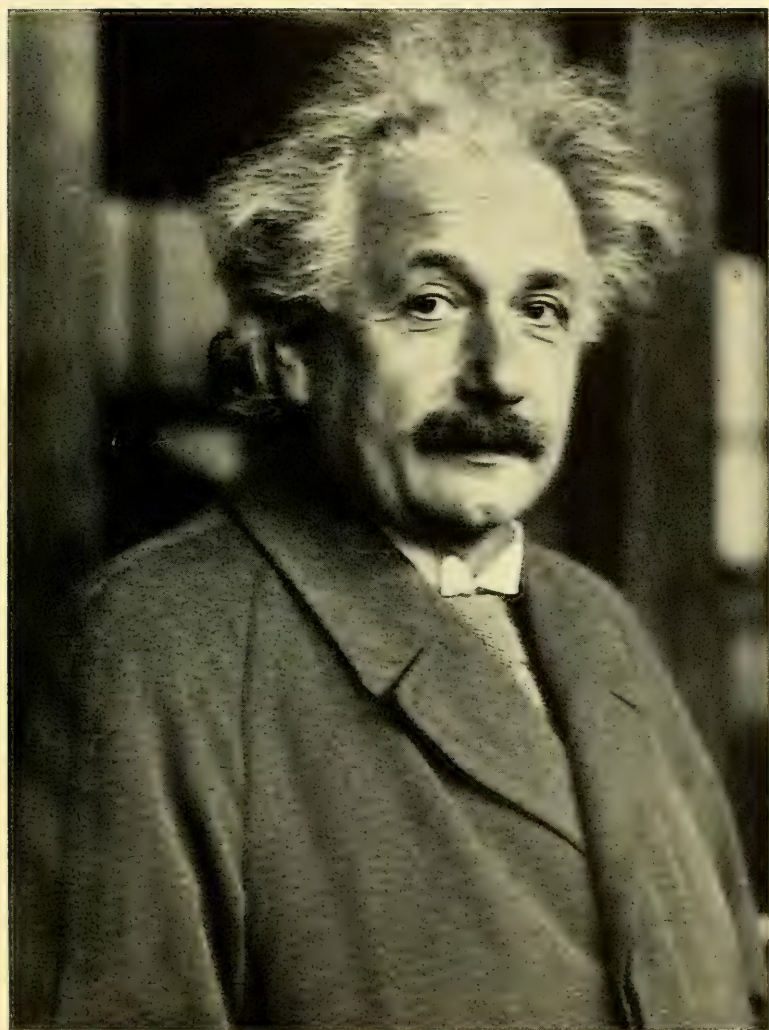
Here is after all the point from which one takes the path that leads to hope or to despair. If there is no purpose in the universe, then indeed there is no God and no good. But if there is a plan, if there is purpose in nature and in human life, then we may feel confident that it is the imperfection of our own mental vision that leads us sometimes to cry "Vanity of vanities, all is vanity." No one can furnish scientific proof of the existence or nature of God, but atheism leads to fatalism and despair, while theism leads to faith and hope and love. "By their fruits ye shall

know them." Science cannot solve the great mysteries of our existence,—why we are, whither we are bound, what it all means. Faith alone assures us that there is definite purpose in all experience. This knowledge makes life worth living and service a privilege.

THE MEETING PLACE OF SCIENCE AND
RELIGION

ALBERT EINSTEIN

ALBERT EINSTEIN lives in Berlin, Germany, where he is director of the Kaiser Wilhelm Institut für Physik. He was born in 1879. In 1921 he was awarded the Nobel prize for physics; and in 1925, the Copley medal of the Royal Society. His publications include *Relativity* (English Translation), and *Zur Einheitlichen Feldtheorie*. Leading men of research place him among the world's great scientists. Professor Einstein is a good amateur violinist. He thinks so much of his violin that he would not bring it with him on a trip to California fearing lest the climate of the Panama Canal would affect it unfavorably. He admits that he goes to his violin for its quieting effects when weary with protracted investigations into cosmic phenomena. He holds to the Christian philosophy that men are here for the sake of other men; and he says that system of ethics which declares that comfort and happiness are the ends is fit only for a "herd of cattle." He abhors war, calling it "low and despicable." The mysterious, to him, is the most beautiful thing in the world, and the source of all true art and science. Einstein says of his theory of relativity, "I believe it to be true but it will only be proved in 1981, when I am dead." When, during a visit to this country, he said, "The only deeply religious men of our largely materialistic age are the earnest men of research," he aroused a storm of disapproval. Yet Professor Einstein's religion, including as it does intense interest in social justice, a devout belief that "what is impetrable to us really exists," and dedicated to "goodness, truth and beauty," is what multitudes are seeking.



VI

THE MEETING PLACE OF SCIENCE AND RELIGION¹

By ALBERT EINSTEIN

STRANGE is our situation here upon earth. Each of us comes for a short visit, not knowing why, yet sometimes seeming to divine a purpose.

From the standpoint of daily life, however, there is one thing we do know: that man is here for the sake of other men—above all for those upon whose smiles and well-being our own happiness depends, and also for the countless unknown souls with whose fate we are connected by a bond of sympathy. Many times a day I realize how much my own outer and inner life is built upon the labors of my fellow-men, both living and dead, and how earnestly I must exert myself in order to give in return as much as I have received. My peace of mind is often troubled by the depressing sense that I have borrowed too heavily from the work of other men.

I do not believe we can have any freedom at all in the philosophical sense, for we act not only under external compulsion but also by inner necessity. Schopenhauer's saying—"A man can surely do what he wills to do, but he cannot determine what he wills"—impressed itself upon me in my youth, and has always consoled me when I have witnessed or suffered life's

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hardships. This conviction is a perpetual breeder of tolerance, for it does not allow us to take ourselves or others too seriously. It makes rather for a sense of humor.

To ponder interminably over the reason for one's own existence, or the meaning of life in general, seems to me, from an objective point of view, to be sheer folly. And yet every one holds certain ideals by which he guides his aspiration and his judgment. The ideals which have always shone before me and filled me with the joy of living are *goodness, beauty and truth*. To make a goal of comfort or happiness has never appealed to me: a system of ethics built on this basis would be sufficient only for a herd of cattle.

Without the sense of collaborating with like-minded beings in the pursuit of the ever unattainable in art and scientific research, my life would have been empty. Ever since childhood I have scorned the commonplace limits so often set upon human ambition. Possessions, outward success, publicity, luxury—to me these have always been contemptible. I believe that a simple and unassuming manner of life is best for every one, best both for the body and for the mind.

My passionate interest in social justice and social responsibility has always stood in curious contrast to a marked lack of desire for direct association with men and women. I am a horse for single harness, not cut out for tandem or team work. I have never belonged wholeheartedly to country or state, to my circle of friends, or even to my own family. These ties have always been accompanied by a vague aloof-

ness. And the wish to withdraw into myself increases with the years.

Such isolation is sometimes bitter; but I do not regret being cut off from the understanding and sympathy of other men. I lose something by it, to be sure, but I am compensated for it in being rendered independent of the customs, opinions, and prejudices of others; and am not tempted to rest my peace of mind upon such shifting foundations.

My political ideal is democracy. Every one should be respected as an individual, but no one idolized. It is an irony of fate that I should have been showered with so much uncalled-for and unmerited admiration and esteem. Perhaps this adulation springs from the unfulfilled wish of the multitude to comprehend the few ideas which I, with my weak powers, have advanced.

Full well do I know that in order to attain any definite goal it is imperative that *one* person should do the thinking and commanding and carry most of the responsibility. But those who are led should not be driven, and they should be allowed to choose their leader. It seems to me that the distinctions separating the social classes are false; in the last analysis they rest on force. I am convinced that degeneracy follows every autocratic system of violence, for violence inevitably attracts moral inferiors. Time has proved that illustrious tyrants are succeeded by scoundrels.

For this reason I have always been passionately opposed to such régimes as exist in Russia and Italy to-day. The thing which has discredited the European forms of democracy is not the basic theory of democracy itself, which some say is at fault, but the

instability of our political leadership, as well as the impersonal character of party alignments.

I believe that those in the United States have hit upon the right idea. They choose a President for a reasonable length of time and give him enough power to acquit himself properly of his responsibilities. In the German Government, on the other hand, I like the state's more extensive care of the individual when he is ill or unemployed. What is truly valuable in our bustle of life is not the nation, I should say, but the creative and impressionable individuality, the personality—he who produces the noble and sublime while the common herd remains dull in thought and insensible in feeling.

This subject brings me to that vilest offspring of the herd mind—the odious militia. The man who enjoys marching in line and file to the strains of music falls below my contempt: he received his great brain by mistake—the spinal cord would have been sufficient. This heroism is commanded; this senseless violence, this accursed bombast of patriotism—how intensely I despise them! War is low and despicable, and I had rather be smitten to shreds than participate in such doings.

Such a stain on humanity should be erased without delay. I think well enough of human nature to believe that it would have been wiped out long ago had not the common sense of nations been systematically corrupted through school and press for business and political reasons.

The most beautiful thing we can express is the mysterious. It is the source of all true art and science.

He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead: his eyes are closed. This insight into the mystery of life, coupled though it be with fear, has also given rise to religion. To know that what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty which our dull faculties can comprehend only in their most primitive forms—this knowledge, this feeling, is at the center of true religiousness. In this sense, and in this sense only, I belong in the ranks of the devoutly religious men.

I cannot imagine a God who rewards and punishes the objects of his creation, whose purposes are modelled after our own—a God, in short, who is but a reflection of human frailty. Neither can I believe that the individual survives the death of his body, although feeble souls harbor such thoughts through fear or religious egotism. It is enough for me to contemplate the mystery of conscious life perpetuating itself through all eternity, to reflect upon the marvellous structure of the universe which we can dimly perceive, and to try humbly to comprehend even an infinitesimal part of the intelligence manifested in nature.²

Everything that men do or think concerns the satisfaction of the needs they feel or the escape from pain. This must be kept in mind when we seek to understand spiritual or intellectual movements and the way in which they develop. For feeling and longing are the motive forces of all human striving and pro-

² The pages which follow are reprinted by the courteous permission of the *New York Times*.

ductivity—however nobly these latter may display themselves to us.

What, then, are the feelings and the needs which have brought mankind to religious thought, and to faith in the widest sense? A moment's consideration shows that the most varied emotions stand at the cradle of religious thought and experience.

In primitive peoples it is, first of all, fear that awakens religious ideas—fear of hunger, of wild animals, of illness and of death. Since the understanding of causal connections is usually limited on this level of existence, the human soul forges a being, more or less like itself, on whose will and activities depend the experiences which it fears. One hopes to win the favor of this being by deeds and sacrifices, which, according to the tradition of the race, are supposed to appease the being, or to make him well disposed to man.

I call this the religion of fear.

This religion is considerably stabilized—though not caused—by the formation of a priestly caste which claims to mediate between the people and the being they fear, and so attains a position of power. Often a leader or a despot or a privileged class whose power is maintained in other ways, will combine the function of the priesthood with its own temporal rule for the sake of greater security; or an alliance may exist between the interests of the political power and the priestly caste.

A second source of religious development is found in the social feelings.

Fathers and mothers, as well as leaders of great

human communities, are fallible and mortal. The longing for guidance, for love and succor, provides the stimulus for growth of a social or moral conception of God. This is the God of Providence, who protects, decides, rewards and punishes. This is the God who, according to man's widening horizon, loves and provides for the life of the race, or of mankind, or who even loves life itself. He is the comforter in happiness and in unsatisfied longing, the protector of the souls of the dead. This is the social or moral idea of God.

It is easy to follow in the sacred writings of the Jewish people the development of the religion of fear into the moral religion, which is carried further in the New Testament. The religions of all the civilized peoples, especially those of the Orient, are principally moral religions. An important advance in the life of a people is the transformation of the religion of fear into the moral religion. But one must avoid the prejudice that regards the religions of primitive peoples as pure fear religions and those of the civilized races as pure moral religions. All are mixed forms, though the moral element predominates in the higher levels of social life. Common to all these types is the anthropomorphic character of the idea of God.

Only exceptionally gifted individuals or especially noble communities rise essentially above this level. In these there is found a third level of religious experience, even if it is seldom found in a pure form. I will call it the cosmic religious sense. This is hard to make clear to those who do not experience it, since it does not involve an anthropomorphic idea of God. The individual feels the vanity of human desires and

aims, and the nobility and marvellous order which are revealed in nature and in the world of thought. He feels the individual destiny as an imprisonment and seeks to experience the totality of existence as a unity full of significance. Indications of this cosmic religious sense can be found even on earlier levels of development—for example, in the Psalms and the Prophets of the Old Testament. The cosmic element is much stronger in Buddhism, as, in particular, Schopenhauer's magnificent essays have shown us.

The religious geniuses of all times have been distinguished by this cosmic religious sense, which recognizes neither dogmas nor God made in man's image. Consequently there cannot be a church whose chief doctrines are based on the cosmic religious experience. It comes about, therefore, that we find precisely among the heretics of all ages men who were inspired by this highest religious experience. Often they appeared to their contemporaries as atheists, but sometimes also as saints. Viewed from this angle, men like Democritus, Francis of Assisi and Spinoza are near to one another.

How can this cosmic religious experience be communicated from man to man, if it cannot lead to a definite conception of God, or to a theology? It seems to me that the most important function of art and of science is to arouse and keep alive this feeling in those who are receptive.

Thus we reach an interpretation of the relation of science to religion which is very different from the customary view. From the study of history one is inclined to regard religion and science as irreconcilable antagonists; and this for a reason that is very easily

seen. For any one who is pervaded with the sense of causal law in all that happens, who accepts in real earnest the assumption of causality, the idea of a Being who interferes with the sequence of events in the world is absolutely impossible. Neither the religion of fear, nor the social-moral religion, can have any hold on him. A god who rewards and punishes is for him unthinkable, because man acts in accordance with an inner and outer necessity, and would, in the eyes of God, be as little responsible as an inanimate object is for the movements which it makes.

Science, in consequence, has been accused of undermining morals—but wrongly. The ethical behavior of man is better based on sympathy, education and social relationships, and requires no support from religion. Man's plight would, indeed, be sad if he had to be kept in order through fear of punishment and hope of rewards after death.

It is, therefore, quite natural that the churches have always fought against science and have persecuted its supporters. But, on the other hand, I assert that the cosmic religious experience is the strongest and the noblest driving force behind scientific research. No one who does not appreciate the terrific exertions, and above all, the devotion without which pioneer creations in scientific thought cannot come into being, can judge the strength of the feeling out of which alone such work, turned away as it is from immediate practical life, can grow. What a deep faith in the rationality of the structure of the world, and what a longing to understand even a small glimpse of the reason revealed in the world there must have been in Kepler

and Newton to enable them to unravel the mechanism of the heavens in long years of lonely work!

Any one who only knows scientific research in its practical applications may easily come to a wrong interpretation of the state of mind of the men who, surrounded by skeptical contemporaries, have shown the way to kindred spirits scattered over all countries in all centuries. Only those who have dedicated their lives to similar ends can have a living conception of the inspiration which gave these men the power to remain loyal to their purposes in spite of countless failures. It is the cosmic religious sense which grants this power.

A contemporary has rightly said that the only deeply religious people of our largely materialistic age are the earnest men of research.

RELIGION: ITS PERSISTENCE AND
HUMAN CHARACTER

JULIAN S. HUXLEY

JULIAN S. HUXLEY, biologist, author and lecturer, was born in 1887. He is a descendant of Thomas H. Huxley the famous supporter and expounder of evolution, and of Dr. Arnold of Rugby. For four years he has been president of the National Union of Scientific Workers. He helped organize and took part in the Oxford University Expedition to Spitzbergen in 1921. Recently he has been pursuing biological studies on the continent of Africa. At the universities of Oxford and of London he has taught a succession of youthful scientists. He has published among other works: *Essays of a Biologist*; *Religion Without Revelation*; *The Science of Life* (with H. G. and G. P. Wells). His approach to religion and the idea of God is that of the humanist; and as such he probably heads the list of thinkers and writers to-day in the scientific field.



VII

RELIGION: ITS PERSISTENCE AND HUMAN CHARACTER¹

By JULIAN S. HUXLEY

TO those religious philosophers who conclude that the universe is God, and to those others who identify God with the philosophical Absolute, the Unknowable behind phenomena, the unifying principle in reality, and so forth, we may legitimately reply that their conclusions may be of great interest for philosophy, but have ceased to have any but the remotest bearing on religion. Such a God could not be worshipped or prayed to, and could not arouse the intense emotion or ecstasy of mystical experience, and, in fact, has really no kinship with the actual gods of actual religions.

Where, then, does the solution lie? It would seem to lie in dismantling the theistic edifice, which will no longer bear the weight of the universe as enlarged by recent science; and attempting to find new outlets for the religious spirit. God, in any but a purely philosophical, and one is almost tempted to say, a Pickwickian, sense, turns out to be a product of the human mind. As an independent or unitary being, active in the affairs of the universe, he does not exist.

The religious emotions of mankind, these many cen-

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turies, have flowed into channels of deity. The forms which they have taken have been in large measure determined by this idea of God or gods. To imagine, as many people do, that religion will cease to exist is to be lamentably illogical. The religious emotions are a natural product of man's nature. Robbed of the outlet of deity, they will find other outlets. No longer moulded by the idea of God, they will be moulded by other concepts, and will manifest a fresh evolution into new forms. And chief among the concepts which will mould this new evolution will be the concepts of science. For knowledge is inevitably the most important raw material of theology.

Can we venture on any prophecy as to the lines which the reconstruction will take? I think we can, although with the proviso that all we can hope to see is the beginning of a development whose end may, and doubtless will be, as different from its beginning as is modernist Christian theology from ancient Egyptian polytheism. Science is yet young. In the coming centuries there are bound to be radical alterations in our ideas about mind, and its place in the scientific scheme.

The first, and in a way, most important ingredient of any religion congruous with science must be a reverent agnosticism concerning ultimates, and, indeed, concerning many things that are not ultimates. Man is a limited and partial creature, a product of material evolution. He is a relative being, moulded by the struggle to survive in particular conditions on a particular planet. We have no grounds for supposing that his construction is adapted to understand the ultimate nature or cause or purpose of the universe,

and indeed, every reason for supposing the contrary.

Quite apart from that we can be sure that there are whole realms of knowledge which he has not yet discovered. The truly religious man must be content not to know many things, of which those that most vitally concern our present quest are the ultimate nature and purpose of the universe, and the truth as to the survival of personality after death.

The obverse of this state of mind is the refusal to mistake wish for fact, the strength of one's desire for a thing, for proof that the thing exists. Most men desire immortality; and this is often adduced as evidence that man is immortal. But it is of the very essence of the scientific spirit to refuse admittance to desire and emotion in the quest for knowledge—save only the one thing of discovering more truth.

The most important characteristic of the scientific method is its constant reference back to experience in the search for knowledge. This also rules out a conception which played an important part in medieval theology—the idea that pure deductive reason and abstract principles such as that of perfection could tell one anything about the nature of things. For Aristotle and the Schoolmen, the heavenly bodies had to be arranged on spheres and to move in circles because these are perfect forms, while ellipsoids and parabolas are not. And from purely abstract principles, such as the goodness of God and the consequent perfection of the universe, all sorts of elaborate deductions were made.

There is, however, no reason why the universe should be perfect; there is, indeed, no reason why it

should be rational. What exists, exists; and acceptance is man's first task. "I am that I am" is a far truer piece of theology than all the deductive philosophy of the scholastics.

A further consequence of the adoption of the scientific outlook must be the break with any rigid or fixed authority in religion, and a willingness to accept change. It has been a matter of frequent comment in recent years that, whereas change in scientific ideas is generally regarded as a mark of scientific progress, change in religious ideas is generally thought of as a mark of religious degeneration. The new conceptions of evolution and relativity are victories for science. But when the belief in miracles is abandoned in favor of natural law, or the theory of the verbal inspiration and absolute rightness of the Bible dropped for one of progressive religious development, the majority of men, whether religious or no, still seem to look upon it as a defeat for religion.

This comes solely from the part which dogmatism and false theories of revelation and authority have played in the past history of religion. It is perfectly possible to be religious and yet to welcome change without forfeiting stability. Science is always changing; but it is not unstable, only progressive. If progress itself be looked upon as a sacred duty, progress becomes an element in religion, and religious change will no longer alarm and shock religious minds.

Hence it is obvious that with the abandonment of the idea of God as a single independent power, with a nature akin to personality, many current religious practices will become meaningless. There will be no room for services of intercession, for prayer in the

ordinary sense, for fear of incomprehensible punishment, for propitiatory sacrifice, or for the worship that is regarded as agreeable to its recipient. Providence turns out to be wrongly named, and the Will of God resolves itself into a combination of the driving forces of nature with the spiritual pressure of abstract ideas and certain of the conscious and subconscious desires of man.

What, then, remains for future religion? In the first place, a recognition of the fact that the religious spirit is a permanent element in human nature, and a potent driving force; that, if it is harnessed in ways which are intellectually wrong its results will eventually prove to be practically wrong; and that, at present, for want of intellectually satisfactory outlets, the religious driving-force of a great many intelligent people is going to waste.

Next, a frank recognition that many of the functions of earlier types of religion are now as well or better carried out by other agencies. There was a time when the Church provided the art, music and poetry of the community whose needs in this respect are now in large measure satisfied by books, pictures, concerts, radio activity, and the rest; a time when it provided the glamour, the rich illusion, and the escape from routine now gained in the theater or the cinema; and the intellectual leadership, now given by philosophers, novelists, men of science and other secular writers.

We can no longer promise salvation in the conventional sense. But it is a simple fact that men and women can come to achieve a sense of harmony and peace, a conviction of the value of existence, a feeling

that their relation with the world at large is no longer confused and meaningless, but right and significant. And any religion worthy the name will help them towards this end.²

What, then, is the picture which science draws of the universe to-day, the picture which religion must take account of (with due regard, of course, for the fact that the picture is incomplete) in its theology and general outlook? It is, I think, somewhat as follows. It is the picture of a universe in which matter and energy, time and space, are not what they seem to common sense, but interlock and overlap in the most puzzling way. A universe of appalling vastness, appalling age, and appalling meaninglessness. The only trend we can perceive in the universe as a whole is a trend toward a final uniformity when no energy will be available, a state of cosmic death.

Within this universe, however, on one of the smaller satellites of one of its millions of millions of suns, a different trend is in progress. It is the trend we call evolution, and it has consisted first in the genesis of living out of non-living matter, and then in the steady but slow progress of this living matter toward greater efficiency, greater harmony of construction, greater control over, and greater independence of, its environment. And this slow progress has culminated, in times which, geologically speaking, are very recent, in the person of man and his societies. This is the objective side of the trend of life; but it has another side. It has also been a trend toward greater activity

² The following pages are reprinted by the courteous permission of the *Atlantic Monthly*.

and intensity of mind, toward greater capacities for knowing, feeling, and purposing; and here, too, man is pre-eminent.

The curious thing is that both these trends, of the world of lifeless matter as a whole, and of the world of life on this planet, operate with the same materials. The matter of which living things are composed is the same as that in the lifeless earth and the most distant stars; the energy by which they work is part of the same general reservoir which sets the stars shining, drives a motor car, and moves the planets or the tides. There is, in fact, only one world-stuff. And since man and life are part of this world-stuff, the properties of consciousness, or something of the same nature as consciousness, must be attributes of the world-stuff, too, unless we are to drop any belief in continuity and uniformity in nature. The physicists and the chemists and the physiologists do not deal with these mind-like properties, for the simple reason that they have not so far discovered any method of detecting or measuring them directly. But the logic of evolution forces us to believe that they are there, even if in lowly form, throughout the universe.

Finally, this universe which science depicts works uniformly and regularly. A particular kind of matter in a particular set of circumstances will always behave in the same way; things work as they do, not because of inherent principles of perfection, not because they happen to be so made that they cannot work in any other way. When we have found out something about the way things are made so that we can prophesy how they will work, we say we have discovered a natural law; such laws, however, are not like human laws, im-

posed from without on objects, but are laws of the objects' own being. And the laws governing the evolution of life seem to be as regular and automatic as those governing the movements of the planets.

In this universe lives man. He is a curious phenomenon: a piece of the universal world-stuff which, as result of long processes of change and strife, has become intensely conscious—conscious of itself, of its relations with the rest of the world-stuff, capable of consciously feeling, reasoning, desiring and planning. These capacities are the result of an astonishingly complicated piece of physical machinery—the cerebral hemispheres of his brain. The limitations to our capacities come from the construction of our brains and bodies which we receive through heredity;—with some one else's body and brain, our development even in the same environment could have been different.

And these conditions in human capacity due to differences in inheritance must be enormous. The method of inheritance in men is identical in principle with the method of inheritance in poultry or flies or fish. And by means of further detailed knowledge we could control it, and therefore control human capacity, which is only another way of saying that man has the power of controlling his own future. Or, if you like to put it still more generally, that not only is he the highest product of evolution, but, through his power of conscious reason, he has become the trustee of the evolutionary process. His own future and that of the earth are in large measure in his hands. And that future extends for thousands of millions of years.

Lastly, we must not forget to remind ourselves that we are relative beings. As products of evolution, our bodies and minds are what they are because they have been moulded in relation to the world in which we live. The very senses we possess are relative—for instance, we have no electric sense and no X-ray sense, because electrical and X-ray stimuli of any magnitude are very rare in nature. The working of our minds, too, is very far from absolute. Our reason often serves only as a means of finding reasons to justify our desires. Our mental being, as modern psychology has shown, is a compromise—here antagonistic forces in conflict, there an undesirable element forcibly expressed, there again a disreputable motive emerging disguised. Our minds, in fact, like our bodies, are devices for helping us to get along somehow in the struggle for existence. We are entrapped in our own natures. Only by deliberate effort, and not always then, shall we be able to use our minds as instruments for attaining unvarnished truth, for practising disinterested virtue, for achieving true sincerity and purity of heart.

I do not know how religion will assimilate these facts and these ideas; but I am sure that in the long run it will assimilate them as it has assimilated Kepler and Galileo and Newton, and is beginning to assimilate Darwin. And I am sure that the sooner the assimilation is effected, the better it will be for everybody concerned.

So far I have spoken almost entirely of the effect of science upon the religious outlook—of the effect of scientific method upon the study of religion itself, lead-

ing us to the idea of development in religion; and of the effect of scientific discoveries in general upon man's picture of the universe, which it is the business of religion to assimilate in its theology. Now I must say something about the limitations of science. Science, like art, or morality, or religion, is simply one way of handling the chaos of experience which is the only immediate reality we know. Art, for instance, handles experience in relation to the desire for beauty, or, if we want to put it more generally and more philosophically, in relation to the desire for expressing feelings and ideas in æsthetically satisfying forms. Accuracy of mere fact is and should be a secondary consideration to art. The annual strictures of Taylor and Cutter on the men's costumes in the Academy portraits are more or less irrelevant to the question of whether the portraits are good pictures or bad pictures.

Science, on the other hand, deals with the chaos of experience from the point of view of efficient intellectual and practical handling. Science is out to find laws and general rules, because the discovery of a single law or rule at once enables us to understand an indefinite number of individual happenings—as the single law of gravitation enables us to understand the fall of an apple, the movements of the planets, the tides, the return of comets and innumerable other phenomena. Science insists on continual verification by testing against facts, because the bitter experience of history is that, without such constant testing, man's imagination and logical faculty run away with him, and in the long run make a fool of him. And science has every confidence in these methods because experi-

ence has amply demonstrated that they are the only ones by which man can hope to extend his control over nature and his own destiny. Science is, in the first instance, merely disinterested curiosity, the desire to know for knowledge's sake. Yet in the long run the new knowledge always brings new practical power.

But science has two inherent limitations. First, it is incomplete, or perhaps I had better say partial, just because it only concerns itself with intellectual handling and objective control. And secondly, it is morally and emotionally neutral. It sets out to describe and to understand, not to appraise or to assign values. Indeed, science is without a scale of values. The only value which it recognizes is that of truth and knowledge.

This neutrality of science in regard to emotions and moral and æsthetic values means that, while in its own sphere of knowledge it is supreme, in other spheres it is only a method or tool. What man shall do with the new facts, the new ideas, the new opportunities of control which science is showering upon him does not depend upon science, but upon what man *wants* to do with them; and this, in turn, depends upon his scale of values. It is here that religion can become the dominant factor. For what religion can do is to set up a scale of values for conduct, and to provide emotional or spiritual driving force to help in getting them realized in practice. On the other hand, it is an undoubted fact that the scale of values set up by a religion will be different according to its intellectual background: you can never wholly separate practice from theory, idea from action. Thus, to put the matter in a nut-

shell, while the practical task of science is to provide man with new knowledge and increased powers of control, the practical task of religion is to help man to live and to decide how he shall use that knowledge and these powers.

The conflict between science and religion has come chiefly from the fact that religion often has been afraid of the new knowledge provided by science, because it had unfortunately committed itself to a theology of fixity instead of one of change, and claimed to be already in possession of all the knowledge that mattered. It therefore seemed that to admit the truth and the value of the new knowledge provided by science would be to destroy religion. Most men of science and many thinkers within the churches do not believe this any longer. Science may destroy particular theologies; it may even cause the downfall of particular brands of religion if they persist in refusing to admit the validity of scientific knowledge. But it cannot destroy religion, because that is the outcome of the religious spirit; and the religious spirit is just as much a property of human nature as is the scientific spirit.

What science can and should do is to modify the forms in which the religious spirit expresses itself. And once religion recognizes that fact, there will no longer remain any fundamental conflict between science and religion, but merely a number of friendly adjustments to be made.

In regard to this last point, let me make myself clear. I do not mean that science should dictate to religion how it should change or what form it should

take. I mean that it is the business and the duty of the various religions to accept the new knowledge we owe to science, to assimilate it into their systems, and to adjust their general ideas and outlook accordingly. The only business or duty of science is to discover new facts, to frame the best possible generalizations to account for the facts, and to turn knowledge to practical account when asked to do so. The problem of what man will do with the enormous possibilities of power which science has put into his hands is probably the most vital and the most alarming problem of modern times. At the moment, humanity is rather like an irresponsible and mischievous child who has been presented with a set of machine tools, a box of matches, and a supply of dynamite. How can religion expect to help in solving the problem before the child cuts itself or blows itself up if it does not permeate itself, and make them its own in order to control them?

That is why I say—as a human being and not as a scientist—that it is the duty of religion to accept and assimilate scientific knowledge. I also believe it to be the *business* of religion to do so, because if religion does not do so, religion will in the long run lose influence and adherents thereby.

I see the human race engaged in the tremendous experiment of living on the planet called earth. From the point of view of humanity as a whole, the great aim of this experiment must be to make life more truly and more fully worth living; the religious man might prefer to say that the aim was to realize the kingdom of God upon earth, but that is only another way of saying the same thing.

The scientific spirit and the religious spirit both have their parts to play in this experiment. If religion will but abandon its claims to fixity and certitude (as many liberal churchmen are already doing), then it can see in the pursuit of truth something essentially sacred, and science itself will come to have its religious aspect. If science will remember that it, as science, can lay no claim to set up values, it will allow due weight to the religious spirit.

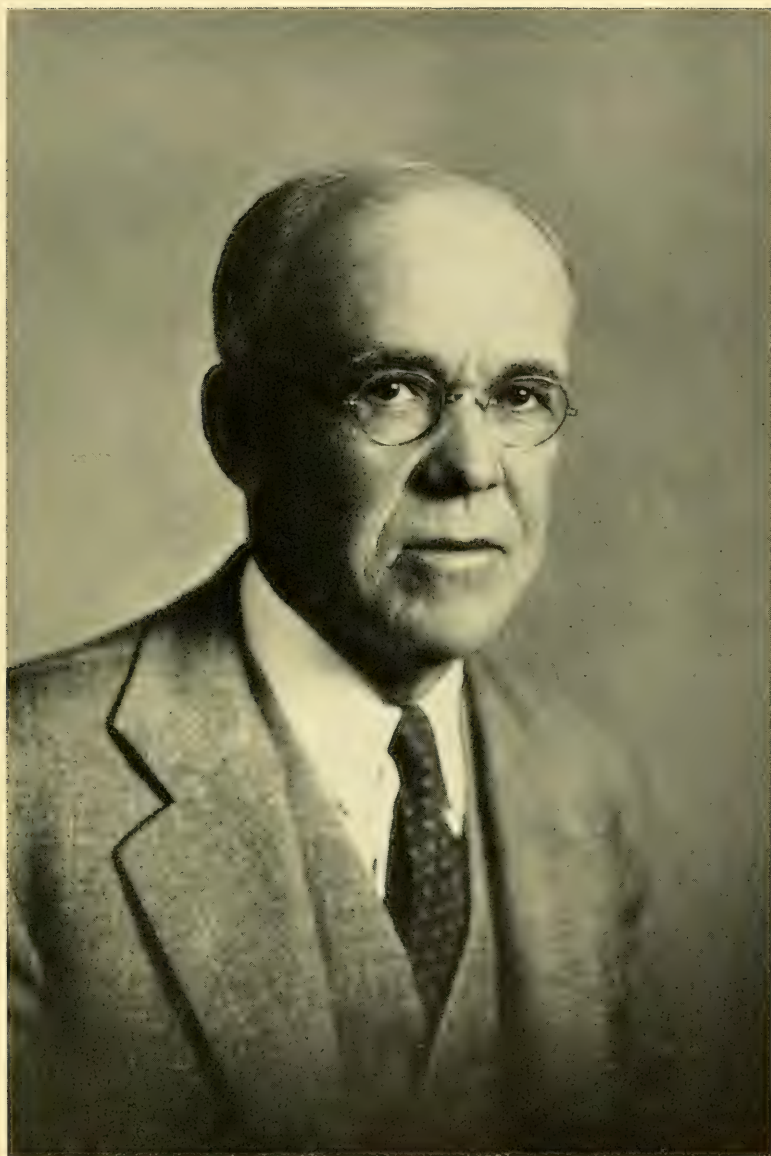
At the moment, however, a radical difference of outlook obtains as between change in science and change in religion. An alteration in scientific outlook—for instance the supersession of pure Newtonian mechanics by relativity—is generally looked on as a victory for science. But an alteration in religious outlook—for instance, the abandonment of belief in the literal truth of the account of Creation in Genesis—is usually looked on as in some way a defeat for religion. Yet, either both are defeats or both are victories—not for particular activities such as religion or science, but for the spirit of man. In the past, religion has usually been slowly or grudgingly forced to admit new scientific ideas.

If it will but accept the most vivifying of all the scientific ideas of the past century,—that of the capacity of life, including human life and institutions, including religion itself, for progressive development,—the conflict between science and religion will be over, and both can join hands in advancing the great experiment of man, of ensuring that men shall have life, and have it more abundantly.

IDEALISTIC CONFESSIONS OF A
BEHAVIORIST

GEORGE THOMAS WHITE PATRICK

GEORGE THOMAS WHITE PATRICK was born in Boscawen, New Hampshire, in 1857. After studying at the State University of Iowa and at Yale, he received the degree of Ph.D. from Johns Hopkins in 1888. In 1894 he studied philosophy at Leipzig University. Beginning 1887, he had a long and honored term of service as professor of philosophy at the State University of Iowa. He also founded the psychological laboratory at that institution. He is author of *The Psychology of Social Reconstruction*; *The Psychology of Relaxation*; *An Introduction to Philosophy*; *The World and Its Meaning*; *What Is Mind*; and other works. Dr. Patrick's book, *An Introduction to Philosophy*, published in 1924, is one of the best treatises on that subject available for readers who wish a popular presentation, but at the same time one conveying complete and sound knowledge. He is a philosopher rather than a scientist. But his approach is scientific, and readers will concede that his paper has so direct a bearing on the paradox of life as affected by religion that it could not well have been omitted from a study of this nature.



VIII

IDEALISTIC CONFESSIONS OF A BEHAVIORIST

By GEORGE THOMAS WHITE PATRICK

THAT the mathematical and physical sciences are now lending less encouragement to a mechanistic or materialistic world view is becoming known even to newspaper readers. But there seems to be still much doubt about the biological and psychological sciences. Mechanistic interpretations of Darwinism still prevail and psychology has become infected with behaviorism.

Perhaps nothing in these days has caused so much concern in religious circles as this new theory of behaviorism. It has produced a kind of shock like Darwin's *Origin of Species* in his day, or the Copernican astronomy long ago. It seems to attack the very citadel of religion—the religious nature of man. It denies, as is supposed, the spiritual character of the soul, its intimations of immortality, its native intuitions of good and evil, its divine character. It denies, it is feared, the very existence of the soul, and teaches that there is nothing in human personality except the material body. Behaviorism, it is said, goes even further than this. It is associated with, if it does not indeed actually teach, a materialistic and mechanistic world theory, where mechanism alone rules, and where God has no place. Surely, behaviorism and religion

have nothing in common. Surely, the assumptions of behaviorism are fatal to any religious view of the world. However, it is added, we do not need to worry about behaviorism, for it is already a passing theory, no longer sanctioned by representative psychologists.

But this indictment of behaviorism is full of errors and misconceptions. I think it would be profitable in the pages which follow to inquire more carefully concerning the meaning of the behaviorist psychology, whether it necessarily implies a mechanistic view of life and mind, and whether it really is inconsistent with our religious beliefs. Religion cannot afford to make any more mistakes in opposing the advance of science, and in our attitude toward this new movement, caution and candor are necessary—and, most of all, understanding.

For instance, when it is said that behaviorists deny the existence of the soul, the latter word is evidently used in some metaphysical sense, unknown to psychologists of to-day. We all agree that such things as thinking, perceiving, remembering, feeling, reflecting, and deciding, exist. No one doubts the existence of these and many other mental processes, and if we did doubt them, the doubt itself would remain as a mental process; and it is just these processes that we mean when we speak of the mind, or of the soul, if you prefer this word. All psychologists study these things, and behaviorists are psychologists. They too study thought and emotion, memory and judgment, joy and satisfaction, reasoning and decision. As for intimations of immortality and intuitions of good and evil—if there be any such, I suppose behaviorists quite as

much as other psychologists, would be eager to study them.

Another initial error, which we may notice here, is the notion that behaviorism is a passing theory, even now neglected by psychologists of repute. The situation is somewhat as follows: Behaviorism was popularized in America by a small school of so-called radical behaviorists. Psychology owes these men a great debt for their contribution to a new and scientific approach to the subject. They insisted that psychology is a natural science and that it deals like other sciences with natural phenomena. The old notion that mind and body belong to two mutually exclusive domains, sometimes called the psychical and the material, still persisted in popular belief, though psychologists had long repudiated it. Many still thought that the soul is some sort of psychic stuff, some kind of spiritual entity, and that ideas are *things* existing *in* the mind. The early behaviorists were eminently successful in further dispelling these beliefs, and in freeing psychology from its metaphysical complications. They spread abroad the view that all those processes which we call mental, such as thinking, feeling, loving, hating, remembering, forgetting, are not "states" of something called "mind," but are different kinds of responses of a living organism, although these responses may be overt or implicit, manual, vocal or visceral, conditioned or unconditioned; and more important still, they proclaimed a new method of studying all mental processes through the objective study of behavior, thus putting psychology on a level with all the other sciences of nature.

All this seemed very strange and radical to the wide circle of readers to whom the early behaviorists appealed, though much of it had been taken for granted by biologists and psychologists, and much of it has now become a part of psychological science.

But the radical behaviorists went further than this, and adopted other views by no means readily accepted by later psychologists, such for instance as their insistence that the human body is solely and exclusively a response mechanism; their refusal to find in introspection, even as experiential observation, an auxiliary method of study; and their curious neglect of the motives of behavior, such as our deep instinctive strivings, desires, appetites, wishes and impulses.

Of peculiar difficulty to other psychologists was the deliberate rejection of the word "consciousness" by the radical group, only partly excused by the unhappy history of the word in modern psychology, where it has often been used merely as a substitute for the discarded metaphysical "mind." Consciousness in the sense of *awareness* is something which could not well be omitted from discussion. The awareness of the deer in the forest in the presence of danger might have served as a point of departure for a naturalistic explanation of the highly developed form which consciousness takes in human beings and would have presented no inherent difficulty.

Still more serious than these omissions was the strong mechanistic interpretation which the radical behaviorists gave to their theory of mind, extending to a purely mechanistic world view. Some of them even became propagandists for such a view, interpreting the whole universe as "the totality of the electron-

proton aggregates and the changes which occur in their special relationships." They believed that the laws of physics and chemistry are sufficient to explain everything in nature, including man and his social relationships.

Of course religion could find little place in such a world view, for the very foundations of religion rest in the belief in God and in the reality and sanctity of ideal values. But it was not behaviorism itself which was antagonistic to religion but the world view of certain radical behaviorists, with the implication that such a view was a necessary outgrowth of their psychology. And it is this radical kind of behaviorism which in some circles has brought the word into disrepute, and not the basal theory itself.

In the present chapter it is not my purpose to inquire into the truth of behaviorism nor to discuss at all the points of difference between the schools. I have in mind only to ask whether the general theory of behaviorism, if it should turn out to be true, would imply a mechanistic or materialistic theory of life and mind, or threaten in any way the reality of mind, or question its dignity and worth. And it is important to try to answer these questions, for the behaviorist point of view, though not that of the extremists, is coming more and more to prevail. As Professor Jastrow says in a recent article, "Evidently we are all behaviorists but how we interpret our behavioristic obligations may determine largely the trend of our psychological interests."¹

¹ Joseph Jastrow, "The Conflict of the Psychologies," *The Scientific Monthly*, November, 1929.

Behaviorism is primarily a method of study. Psychologists had become discouraged in trying to establish a science of the mind by the introspective method, where no observer could check the observations of any other observer, and turned to the objective method pursued by all the advancing sciences. They began studying mental processes through the behavior of living beings, where the results of that study could be checked and verified. When this method was adopted, the new science began to make an advance comparable with that of all the objective sciences.

It soon became evident to psychologists that in studying mental processes in this way they were not studying the expression of some inner being called the mind or soul, but that they were studying the mind itself directly. This means nothing more than that we are *doing something* when we think, reason, plan, remember, and make decisions. It is the man himself who thinks and feels and wills—not some magical, mysterious, metaphysical soul. The soul, indeed, is born in activity—in behavior. The soul or mind is the name we give to the totality of psychical or mental processes, and by mental processes we mean those activities of living beings by which they adjust themselves to their surroundings in such a way as to maintain their integrity and satisfy their desires. Behavior and its motives and their organization into a definite personality thus become the object of the study of psychology.

Mental processes are therefore wholly distinct from biological and physiological processes. Physiological processes have to do with the maintenance of the inner economy of the organism, while psychological proc-

esses are concerned with the interactions between the organism and its environment. So we see that it is adaptive behavior which is the subject-matter of psychology. Reflex, instinctive, and habitual responses are all of this adaptive kind. Eventually, living beings acquired more complex forms of response. They learned, for instance, to be *resourceful*—to devise new and different ways of dealing with situations to the end of furthering their needs. Then intelligence was born—and mind.

Thus mind is not a function of the brain, or of any of the bodily organs. The function of the brain is primarily that of an integrative organ mediating between receptors and effectors. What we have to do with in psychology is the behavior of the whole individual in his intercourse with his surroundings, together with his motives governing this behavior, and the organization of the whole into a personality. In this respect the German *Gestalt* psychologists have corrected the one-sidedness of the extreme behaviorists, putting the emphasis upon organization and the behavior patterns which follow upon the total situation.

So we see that when we think, remember, plan, devise, reflect, decide, we are always in action. The activity may be outward or inward, explicit or implicit; but it is activity. Perceiving, thinking, remembering, are what we human beings are doing in certain circumstances. It is not the mind which thinks and remembers; we think and remember—and it is because we can think and remember that we have minds. We do not solve problems because we have intelligence;

we have intelligence because we can solve problems. Man has developed the capacity to think and reason, to love and hate, and in so doing he has become a living soul.

The relation of soul and body has, from the earliest times, constituted a problem for psychology, perplexing both psychologists and philosophers. The keenest minds have labored with it and big books have been written about it. The theory of behaviorism offers a solution so easy and simple that it seems scarcely to need defense. One has only to compare it with other classical attempts at the age-old problem. Sometimes it has been supposed that the soul is of a wholly different essence from the body—a separate kind of entity, something wholly spiritual, as we say. This is the theory known as psychological dualism. But dualism of this kind is scarcely in vogue at the present time, not being acceptable either to philosophers or psychologists.

The second method has been to make the supposition that matter itself, and of course the body of which it is composed, is in its ultimate character of a mental or spiritual nature. But recent science finds little support for this view. We are coming to know a great deal about matter and its elements, and it does not seem to be of a spiritual or mental nature. We may analyze it into molecules, atoms, protons, and electrons, but we do not find anything like mind-stuff.

Just now we are coming to believe that the ultimate units of our physical world are of the nature of "wave packets." Though these wave packets cannot be conceived as material things, neither are they mental or spiritual things. Though they are no longer believed

to be subject to mechanical laws, neither are they governed by psychological laws. Though they may be grasped only by mathematical thought, there is no evidence that they are themselves of the nature of thought. To import into them anything of a psychical character would be wholly gratuitous, having no support from present-day science. It would be only a theory put forward on the ground that we need something psychical in the original substance of nature in order to explain how the psychical arises in nature.

But we know now that it is not necessary, if we would confirm the reality of the mind and the spirituality of the world, to import these qualities into the elements out of which the world is made. The farther back we go into the elemental nature of things the more rigidly mathematical it all becomes. If we seek for vital things, for life and mind, for love and beauty, for justice and intelligence, we must look forward, not backward. We have come to believe that evolution is a creative process, that the real things of the world, the significant things, are not the elements out of which the structures are made but the structures themselves—the wholes rather than the parts. The elementalism of the nineteenth century is giving place to the organic view of the twentieth century, and to renewed studies into the meaning of evolution.

Recent theories of evolution have departed so far from Darwin's views that the supposed mechanistic implications of Darwinism have lost much of their force. In fact, the new theories of emergent and creative evolution have virtually made obsolescent the ancient and unproductive controversy between the ma-

terialists and idealists. A new meaning has been given to the whole world movement, since we have discovered that evolution is creative. It is now believed that it is not at all an unwrapping process. Its meaning is not expressed by the word *development*, nor indeed by the word *evolution* itself. Evolution is rather a creative up-building process. It is epigenetic, to use a more technical term.

We are not obliged therefore to choose between a materialistic or mechanistic universe on the one hand and a dualistic or a spiritualistic world on the other hand. There is quite another way to look at the whole subject. We are to take the theory of evolution very seriously, but we find that it does not lead in the direction of a mechanistic universe. Nor, on the other hand, are we compelled to suppose that there is something called mind which runs parallel with the body, or resides in the body. Nor, again, are we forced to accept any of the older forms of idealism, which taught that the whole universe is composed of mind-stuff, or that it is merely the externalization of something wholly spiritual.

The world is not a rearrangement of a throng of lifeless atoms, but the awakening of them into a world of living, feeling, and thinking forms. It is not necessary to read back the ideal values into the physical units out of which our world is made. The ideal values are new creations, "special creations," to use a religious phrase. They are values which are "realized" through a process of evolution.

Aristotle was the first to teach that the world is a process of realization. Formless matter is ever taking on form—that is, becoming real; for to Aristotle form is a term covering the qualities or powers which

make anything what it is. We can easily understand this wonderful conception of the wise old Greek philosopher. The Parthenon, the sublime example of Greek architectural art which graces the Acropolis at Athens, and which in Aristotle's time shone in all its splendor, finds its significance, its meaning, its reality, not in the marble of which it is composed, but in its form, its idea, its beauty. It was the expression of Greek ideals, the fruition of Greek art. Any one can dig marble out of a quarry, but only a supreme artist can make it into a Parthenon. So it is not what the world is made out of that is significant, but what it is made into.

It seems strange therefore in appraising the world around us, in trying to form a judgment as to its ultimate materiality or ideality, that we should take the atoms so seriously, or the protons and electrons, or whatever the final units shall prove to be, torturing the facts sometimes to prove that these final units must in their inner being resemble minds or souls or centres of consciousness.

We do not need to take the atoms so seriously, because the things which are made out of them do not have the same qualities as they themselves have. Salt does not have the properties of the sodium and chlorine which compose it—but new and strange ones. Judging from its two elements, we should suppose it to be a corrosive poison, but it turns out to be a useful and agreeable condiment. Vital organisms do not have the properties of the inorganic elements composing them, but new and almost miraculous properties, such as growth and reproduction. Further on in the history of evolution appear very complex and highly integrated organisms, which again display new and

still more marvelous properties and powers, such as invention, imagination, reflective thought, volition, and emotion. These were not potential in the simple organisms, nor in the primeval slime, nor again in the world of protons and electrons. There is another factor in the situation not taken into account by the elementarists of the nineteenth century. And this factor is *organization*.

Tyndall said that in matter he saw the promise and potency of all life. This was a high-sounding pronouncement and impressed his nineteenth-century hearers. But his saying was not based on any observation of facts. He reasoned simply on *a priori* grounds that since once there was nothing but matter and now there is life and action, the former must have contained potentially the latter. But present in the world there was something else than "matter"; there was the fact of organization, and with the organism there emerged new properties and new capacities.

Thus evolution is creative.² Something new is ever appearing. Living beings are not aggregates of dead

² Creative Evolution is a better term than emergent evolution. The reader may be interested in reading or reviewing some recent articles and books by distinguished scientists and philosophers on this subject. Compare:

William Morton Wheeler. *Emergent Evolution and the Development of Societies*. New York. 1928.

C. Lloyd Morgan. *Emergent Evolution*.

H. S. Jennings. "Diverse Doctrines of Evolution," *Science*, January 14, 1927.

William McDougall, *Modern Materialism and Emergent Evolution*. Robert K. Nabours. "A Third Alternative: Emergent Evolution." *The Scientific Monthly*. November, 1930.

Roy Wood Sellars. *The Principles and Problems of Philosophy*. Chap. XXIV.

S. Alexander. *Space Time and Deity*.

C. D. Broad. *Mind and Its Place in Nature*. Chaps. II and XIV.

Compare also the writings of R. S. Lillie, G. H. Parker, C. J. Her-
rick, W. E. Ritter, and H. F. Osborn.

atoms; they are organisms, and have the characteristic properties of organisms. Evolution is not a process of drawing out what is potential in certain lower forms of being, but a process of building up something new upon these lower forms. The nineteenth century had its gaze fixed upon the lower forms, upon the elements of things, hoping to find Nature's secret there. The twentieth century is turning rather to the whole process of evolution itself, and hopes to find its real meaning not in what it works with, but in what it works out, believing that the final result is a better expression of reality than the original material.

The critics of Darwinism were wrong in supposing that evolution is the gospel of despair. It appears to be the gospel of hope, since it means the successive upspringing of more and more complex and highly integrated organisms with their accompaniment of new powers and capacities, such as the capacity for growth and reproduction, the capacity for feeling and emotion, for thought, memory and imagination, for æsthetic enjoyment, for creative and inventive genius, for moral progress, for religious worship. Spencer has been censured for his identification of progress and evolution, but nevertheless evolution is progressive, since science, art, religion, and philosophy are all its outcome, as well as the human mind itself. Spencer's error was in applying evolution to the future of society. Even here there is, no doubt, progress, though perhaps not in the narrow time limits of the Spencerian sociology.

The history of evolution has been a history of new forms and new functions. It bears none of the marks of a wholly mechanistic process, since it transcends

mechanism at every new step. Mechanism is just one aspect of the process, representing force, compulsion and identity, repeating itself forever. Evolution represents growth, progress, achievement. Differences, not identities, characterize it, and the differences are cumulative, and seem to imply some end or purpose. Whether it really is a purposive movement need not be contended here, but it is certainly expansive. Even the stellar universe, as present astronomy seems to be teaching, is an expanding universe. In other words, it is not really a universe, but something growing, enlarging, constantly outgrowing itself—perhaps an organism.

To us this growth and expansiveness is best seen in organic evolution of plants and animals. Organic evolution is a series of increments and pluses. Even a Darwinian variation, upon which the whole system of natural selection depends, is a veritable plus, a novelty. It is something wholly new, therefore a creation—perhaps an achievement.

In evolution, nature is constantly outgrowing itself, outdoing itself, as if it were propelled by some inner motive of expansion, or some primeval uplifting force, or else perhaps drawn on by some timeless power of attraction. Whether the upward striving of the world toward life and mind, toward science and art, toward greater moral values, finds its spring and motive in some primeval creative power or in some immanent divine life, or in some absolute Platonic Good, the conception in any case is essentially religious.

The mechanistic interpretations of Darwinism prevalent in the early days of this century were quite gratuitous. Darwin himself did not enter upon the

philosophy of evolution. He did not profess to understand the causes of variation or to explain the fact of geometrical increase. And yet this expansive and exuberant feature of nature is the one most significant thing in the whole movement. Darwin's chief interest was in displaying the *fact* of evolution and proposing a theory of its *method*. Our interest is more and more turning to evolutionary philosophy. To some recent authors it looks very much like a "grand strategy." Many now speak of "creative evolution." A world-famous biologist has said, "If we personify 'animate nature,' it must at least be as an artist with inexhaustible imaginative resources, with extraordinary mastery of materials."

Darwin was quite right in saying that the mind as well as the body is the product of evolution, but it does not follow from this that mind has grown *out of* lower forms of life. It is not implicit in animal behavior. The mind of man is not something hidden in the simple responses of the lower animals, any more than the modern ocean liner is implicit in the old side-wheel steamboat, or the art of the Renaissance hidden in the pictographs of the cave dwellers. In both illustrations we know that something has been added; namely, almost infinite labor, thought, and creative genius. The future of organic evolution is therefore unpredictable, as are also human conduct and social institutions. Only this is sure, there will be progress.

It would seem, then, that the mind, though defined as the characteristic behavior of a highly complex and highly integrated living organism, has escaped far

from the world of mechanism, if indeed there is any world of pure mechanism. The terms descriptive of mind have no mechanistic coloring. The mind, itself created, is creative. It grows, expands, contrives, invents, aspires. It has visions of beauty and goodness. It envisages a better art and literature, a more equitable distribution of wealth, a better social order, higher moral standards. It is never satisfied with what it has attained. It aspires to more complete control and a larger freedom. It is just because of the marvelous powers of the mind that there has always been a tendency to refer these to some meta-physical *psyche* or soul, an animistic survival of the custom of primitive man to explain the wonderful and strange by attributing them to "spirits." But there are other ways by which spiritual values may be gained. They may be won, *realized*, through a half billion years of evolutionary growth.

So we see that the mind loses nothing of its reality from the standpoint of behaviorism, nor does it suffer any loss of worth or dignity. On the contrary, as the characteristic activity of the most highly complex and perfectly integrated organism which organic evolution has produced, it would appear to occupy the highest position in the world of living things, unless indeed we except the creations of the mind itself, such as science, literature and art.

Personally I like to think of the world movement as a process of realization—and there is surely nothing in a behaviorist psychology to discourage such a conception—in which life and mind are values which have been *realized* in evolution. The process through which they have been realized seems to be a process

of organization, more and more complex organisms giving rise to higher and higher forms of activity, till the human mind itself appears as the highest value. And yet, I suppose, we have no right to think that it is the highest value, for social organization, love, sympathy, and justice are values whose meaning the mind itself is beginning rightly to understand. It can even envisage for the future a form of social organization in which love and sympathy may be ideally combined with justice. Plato, to be sure, would have us believe that love and justice are ideal, eternal values, whose kinship the soul recognizes and whose form it hopes to imitate. Is there any reason why the ideal values may not be eternally real and yet in a time series such as ours gradually realized? Such a conception of the world would certainly be both religious and idealistic.

The organismic philosophy and the organismic psychology of the present day rest upon the superlative importance of organization in the world movement. This raises the question of the causes of organization, the organizing power in the universe. A purely physico-chemical theory, assuming chance collisions and fortuitous configurations of atoms, has often been proposed. But the rôle of chance is steadily declining in modern science, and purely physico-chemical theories of the world are losing much of their prestige as the sphere of mathematics is widened. Other sciences are challenging the right of physics and chemistry to the prerogative position which they have held during the later decades of the last century and the earlier ones of this century.

Science does not yet understand the causes of pro-

gressive organization, but it certainly presents no aspect of a chance affair. Some creative agency seems to be at work. Lloyd Morgan, biologist, psychologist, and philosopher, following the religious teachers of all ages, calls it God. John Burroughs spoke of an organizing principle. Other scientists speak of "a universal compulsion to constructive action," a "drift," or "tendency," or "organizational factor," an "evolutionary urge," or "a struggle for freedom." Some of these terms, like Bergson's *élan vital*, imply the presence in nature of some resistant stuff, against which the "vital impulse" or struggle for freedom is working.

Recently, however, there seems to be a tendency in both science and philosophy to speak less of the struggle for existence or for freedom, and more of an initial or eternal principle of growth and expansion. Evolution is understood to be not a mechanical elimination of the unfit among random variations, but something more like an achievement. Nature is continually outgrowing itself, and trying to do so. Life and the world are not, as one writer says, struggling against an alien force, but struggling to overcome simply the past.³

Thus we see that a behaviorist psychology does not ally itself with any mechanistic or materialistic world view. Whether it implies an idealistic philosophy depends upon our use and understanding of the latter term. It surely encourages no kind of "mind-stuff" theory, nor does it lead in the direction of any of the older forms of subjective, objective, or absolute idealism. It does seem to harmonize with the general view

³ Compare Dr. John Wild, "The Grand Strategy of Evolution." *Essays in Philosophy*. Chicago; Open Court Pub. Co.

of evolution as the gradual realization of ideal values, and to this extent suggests an idealistic philosophy. We may think of mind as an ideal value which some creative power has realized through a long period of evolution. We may regard evolution as a kind of blossoming-out process, in which life and mind, the love of justice, and the appreciation of beauty, have been achieved through long ages of development. What lies still beyond, we do not know.

But the future of humanity on this earth will be long—millions of years, we are told. There will be men and women a plenty, and behavior a plenty, and eventually good behavior. In the meantime whole civilizations may collapse in the presence of luxury, moral laxness, and social indifference. Organized intelligence, such as even now is taking many forms, may avert such disaster—assisted, let us hope, by the emergence of some great devotion, essentially religious in its character.

PSYCHOLOGY AND THE THOUGHT
OF GOD

WILLIAM McDUGALL

WILLIAM McDUGALL, psychologist, was born in Lancashire, England, 1871. He was associated with the English universities until 1920, when he came to the United States to be Professor of Psychology at Harvard University. He remained at Harvard until 1927 when he resigned to become Professor in Duke University. From 1914 to 1919 he was Major of the Royal Army Medical Corps. He is Fellow of the Royal Society of London. His religious preference is Unitarian. Professor McDougall has written continuously since 1905 when his book, *Physiological Psychology*, appeared. In succession have been published, *Social Psychology*; *Pagan Tribes of Borneo*; *Psychology*; *Body and Mind*; *Group Mind*; *Is America Safe for Democracy?*; *Outline of Psychology*; *Ethics and Some Modern World Problems*; *Outline of Abnormal Psychology*; *Janus*; *Character and the Conduct of Life*. In the article which he contributes to this symposium he presents the mature conclusions of a reverent psychologist.



IX

PSYCHOLOGY AND THE THOUGHT OF GOD

By WILLIAM McDUGALL

THIS article is my response to an invitation to say what evidence in support of the theistic hypothesis or the thought of God seems to me to be yielded by psychology. Since psychology is not yet a consistent body of generally accepted facts and theories, since we have, rather, many psychologies of widely different types, using widely different fundamental assumptions and pointing to general conclusions as widely different as pure materialism and pure idealism, I cannot pretend to expound the bearing of psychology in general on the problem of theism. I can only attempt to indicate concisely how my own lifelong labours in psychology affect my own attitude toward this problem.

Let me say first that I have now and have always had an open mind towards this great question. I am and have always been agnostic; not in the negative sense in which that word is often used, not in the sense that I assert the impossibility of knowledge of God or of well-founded belief in Him. I am agnostic in the true sense; that is to say I confess that I myself have not found such evidence as convinces me of the truth of the theistic hypothesis. I should add also that I am not strictly neutral in this matter. I would

prefer to accept Theism, or, if you like, I am biassed in favour of the hypothesis. I recognize the moral and emotional advantages of theistic belief, so abundantly set forth by thousands of eloquent exponents. But, as a man of science, I hold it to be my business to put aside this preference, this bias, to discount it as completely as possible and to endeavour to exercise strictly impartial judgment and reasoning in seeking to reach a tentative conclusion. In other words I hold that I have to treat the existence of God as a question of fact, and that, like all other questions of fact, it must be treated by me as a problem of science rather than a problem of philosophy. Here, since the provinces of science and of philosophy and the demarcation of them are so variously conceived, it is proper that I should say how I conceive those provinces and that demarcation.

I hold that the true and sole province of philosophy is the realm of values, that philosophy is properly concerned with the consideration of values, with valuation, with problems of right and wrong, of better and worse, in every field of activity, in logic, in æsthetic, in morals, in politics, in economics, in jurisprudence, and in religion. All questions of fact, all attempts to describe the actual nature of the universe or of any part of it, to state the relations between its parts, to state the influences exerted by one part on another, to explain the course of events, all this is the work of science.

Hitherto the tasks of science and of philosophy, as thus defined, have been confused in a manner that seems to me highly detrimental to both. Men of science have presumed to pronounce upon values, to

deduce conclusions as to values from their findings, and philosophers have presumed to determine questions of fact by introducing considerations of value; indeed what has commonly been called philosophical treatment of questions of fact and existence is distinguished from scientific treatment by the introduction, explicitly or surreptitiously, of considerations of value. In other words, the philosopher, in attempting to determine questions of existence and reality has been swayed by considerations of value; in trying to say what is, he has allowed his judgment and reasoning to be swayed by considerations of what, as he judges, ought to be. And this confusion of the realms of fact and value, of science and philosophy, has been especially pervasive in the sphere with which this volume is concerned.

Let me put the matter in another way. Just as there is a science of conduct (which is part of psychology) and also a philosophy of conduct, as there is (or may be) a science of æsthetic (the psychology of the beautiful) and also a philosophy of æsthetic, so there is (or may be) a science of religion and also a philosophy of religion. It is for philosophy to show us the values of religious beliefs for mankind; it is for science to weigh the evidence on which those beliefs are founded and to attempt to reach a conclusion as to the degree of probability attaching to them. To the theologian or to the religiously minded man of science, this strict division of functions may seem a cold-blooded counsel of perfection. Yet in this, as in all other fields, the man of science must strive to be as cold-blooded as possible.

Acknowledging, then, the great value of theistic belief, admitting even that it may be and may long have been an essential condition of the welfare and progress of mankind, admitting that its decay might well result in the moral decadence and destruction of the human race, I put all such considerations aside and ask myself cold-bloodedly what evidence in support of Theism do I find in my studies of the mind?

Let me make clear also that I am leaving on one side all other evidences, such, for example, as evidences of design in the physical realm or in the adaptation of the organic realm.

I accept organic evolution as established fact; but I hold that we have no adequate theory or explanation of the way in which it has been effected. On the other hand, the view, commonly accepted by men of science, that living things have been evolved from a realm of inorganic matter and energy that preceded them in time, does not seem to me to be established; indeed it seems to me very improbable and to be regarded with much suspicion.

So much by way of clearing the ground and defining my initial position. I can best proceed by rejecting as unproven and improbable certain views or theories that are widely accepted by psychologists and by indicating the alternative view to which I incline.

I do not believe that what we call mental activity or experience or consciousness is a by-product of the chemistry and physics of the brain, an epiphenomenon, as T. H. Huxley called it. Nor do I believe that the relation between bodily and mental processes can be stated in terms of parallelism without interaction.¹ I

¹ Cf. my *Body and Mind*. Macmillan Company. 1912.

believe, on the contrary, that mental, that is to say intelligent and purposive, activity is of very real causal efficacy, not only in the human species, but all through the animal world and probably in the whole realm of living things. I believe that such activity implies a type of organization that cannot be adequately described in terms of physics and chemistry as they now exist, implies, in fact, organization that cannot be expressed in terms of the spatial distribution of matter or of energy or electrons or any other physical entities or substances. I strongly incline to believe that such organization may, in the case of human beings, be such, or may attain such a degree of stability, that it may survive the dissolution of the body. I do not claim that this is yet a strongly founded view, but I think there is much evidence that points this way and I can see nothing in the teachings of science that makes it impossible or even very improbable.²

I hold that the balance of all the evidence points very strongly to the view that mental activity (in the sense defined above) has been a principal factor in organic evolution, one of increasing influence and efficacy as the higher forms of life have been evolved; until in mankind it has become of overwhelming importance, playing the chief part in determining the welfare and the survival of individuals and of the race.

I hold also that we have conclusive reasons for holding that the mental activity expressed in all behaviour conforms to laws quite other than those formulated by

² Cf. my *Modern Materialism and Emergent Evolution*. Van Nostrand Co. 1928.

physical science in the light of its study of the inorganic realm, especially in that the laws of physical science make no reference to the future course of events and are, in that sense, mechanistic; whereas the activities of mind can be expressed only in teleological laws, laws which necessarily and inevitably, refer to the future; in other words and objectively, all mentally controlled processes are teleological, involve a form of causation in which some mental reference to the future plays an essential part, whereas physical causation seems to imply no such factor.

Psychology, then, in my view, affords convincing evidence of the reality and efficacy of Mind in Nature: and it affords strong, though not conclusive, evidence that mental organization is not wholly dependent upon the physical structure of the human organism. Suppose these indications to be confirmed, leaving no room for doubt:—What, if any, would be their bearing on the problem of theism? So far as I can see, the bearing would be what I would call permissive only. Demonstration of the reality and of the causal efficacy in Nature of Mind or Spirit (as we know it in ourselves) and of its relative (at least) independence of the physical realm, would give countenance to the assumption of Mind or Spirit existing and operating on a vaster scale of influence and of efficacy of directive and creative power; and that, I take it, is the fundamental assumption of all Theism. But it would not in itself amount to proof or even to evidence of the truth of this assumption.

Another preliminary question must be briefly dealt with. It is widely held that psychology shows that, man being what he is, the development of theistic be-

liefs by many, perhaps all, races of mankind was inevitable. Many psychologists seem to hold that this, if true, negatives all theistic belief, proves it to be illusory, and some of them assert as much. This seems to me a *non-sequitur*. I accept the premise, but cannot see that the conclusion follows. If man's nature were not such as to engender theistic belief, no such beliefs would be held by men, the truth of Theism, if it be true, would have remained undiscovered by man, or would not have become widely held. In exactly the same way, man's nature is such that he readily believes in ghosts; but this fact neither proves nor disproves the reality of ghosts. The fact merely renders it the more necessary to be very cautious and critical in examining the evidence.

Turning now directly to the question—Does psychology yield any positive evidence in support of Theism?—I consider two possible kinds of evidence. First, is there any form or type of experience or of mental activity that is in itself evidence in support of Theism? Secondly, does man possess any one or more capacities that cannot be regarded as having been evolved in the race in essentially the same way as other capacities (such as are shared in some degree by the animals), and which, therefore, point to some “supernatural” origin and constitute a special endowment, giving him a position in the world of life of an order quite other than that of the animals.

The religious emotion *par excellence* is reverence. But neither reverence nor mankind's capacity for reverence seems to stand in any exceptional or peculiar relation to the rest of his nature. They seem to be

merely higher developments of experiences and capacities present in rudiment in the animals. And to worship is to express actively the tendencies intrinsic to the sentiment of reverence. Much has been made by Dr. Rudolf Otto, in his *Idea of the Holy*,³ of what he calls the feeling of the numinous. But I cannot see that this implies any other emotional or perceptive capacities than those sketched in my *Social Psychology* as specially involved in religious experience.⁴ The same remark applies to that "sense of the beyond," of the limitless, of the powers transcending our comprehension, in which others see the essential kernel of all religion. And the alleged fact that all men need religion or a God does not (if it be a fact) seem to me to imply any guarantee that the universe is such as to provide satisfaction for that need. It might equally well be argued that, since all children delight in fairy

³ English Translation. Oxford Press. 1926.

⁴ Otto claims to describe a mode of emotional experience that is first, specifically and peculiarly religious, and secondly, carries with it a guarantee of the objective reality of the object to which it refers. I cannot see that he is successful in either part of this double project. In describing this "element" in experience he writes: "The feeling of it may at times come sweeping like a gentle tide, pervading the mind with a tranquil mood of deepest worship." Also: "It has its wild and demonic forms and can sink to an almost grisly horror and shuddering." And he says many other things about it; all of which go to show clearly that he is really dealing with a large range of complex emotional experiences, the common factor in which is *awe* or the "feeling of the uncanny." He writes: "It first begins to stir in the feeling of 'something uncanny,' 'eerie' or 'weird.' It is this feeling which, emerging in the mind of primeval man, forms the starting point for the entire religious development in history." This seems to me true enough. But Otto goes on to say (and this is the pith of his argument) that this "is only possible to a being in whom has been awakened a mental pre-disposition, unique in kind and different in a definite way from any 'natural' faculty. And this newly-revealed capacity, even in the crude and violent manifestations which are all it at first evinces, bears witness to a completely new function of experience and standard of valuation, only belonging to the spirit of man." In this I cannot follow him. In my *Social Psychology* I have shown that awe can properly be regarded as a synthesis of fear, curiosity and sub-

stories, readily believe them and crave for fairies, therefore fairies exist.

Kant seems to have felt that man's capacity for moral development was of peculiar significance. But in the light of evolutionary theory, it seems no more difficult to understand as a product of natural evolution than his capacity for fighting, or for playing. All have their obvious biological functions. The higher animals show the germs of all our moral qualities, especially that most central of them, the tender care for other creatures. Apart from the influence of a moral tradition, product of a long process of accumulation and refinement, the best man among us would hardly rise in the moral scale above the level of a fine or, as we almost inevitably say, a noble dog.

Reason is a chain of judgment involving considerable power of abstraction; but the germs of these powers are exhibited by animals. And here again man owes his superiority in the main to his sharing in a

missive feelings; and that reverence is a still more complex synthesis into which tender feeling enters. Unless it can be shown that this analysis is wholly wrong or inadequate (and Otto makes no attempt to examine the question), Otto's contention (that experiences of these kinds imply a "mental pre-disposition, unique in kind and different in a definite way from any 'natural' faculty,") has no claim upon serious consideration.

I may add that Otto's distinction between the rational and the non-rational in experience, on which much of his argument turns, is very unsatisfactory, resting as it does on the old-fashioned and very misleading psychology of concepts as entities that play some essential rôle in all rational processes; rational experience, he says, is such as can be "formulated by means of a concept"; irrational experience cannot be so formulated. For an exposition of the fallacy here involved I must refer the reader to my article "The Confusion of the Concept" in the *Journal of Philosophical Studies*, 1928. Otto writes: "We should see the facts more clearly if psychology in general would make a more decisive endeavor to examine and classify the feelings and emotions according to their qualitative differences." Here I agree entirely; but I must maintain that Otto himself has signally failed in his particular endeavor along this line.

slowly accumulated tradition, especially the tradition of language; and the biological and social utility of these powers are very high. The exercise and development of them was, no doubt, both the ground and the essential condition of the rise of man's ancestry above the animal plane.

Four forms of experience and human capacity alone seem to me to afford some direct support to the theistic hypothesis.

First, the experiences of some mystics. I need not cite again examples of what I refer to. Since William James published his *Varieties of Religious Experience* the polite world has been well acquainted, in third-hand fashion, with the facts. It does not seem to me that the mystic experience of union or communion with God or with the All, as reported by any one person, no matter how utterly convincing to him, can be accepted as evidence of appreciable weight in support of Theism or of Pantheism. It is the comparative study of such reports that seems to me to yield evidence that cannot be lightly brushed aside. Edmund Buck, in his *Cosmic Consciousness* (recently republished) made such a comparative study. The most striking fact which he brought out was the close similarity in detail of the mystic experiences reported by a number of persons widely separated in time and place and having no knowledge of one another. For example, a number of these persons report that they suddenly and unexpectedly fell into, or were thrust or drawn into, a state of being entirely novel and strange, of which a leading feature was an impression of vivid illumination, illumination not metaphorical or intellec-

tual, but physical, as though by a sudden burst of sunlight in a dark place.

This and other recurrent features of the mystic experience seem to run true to a definite type; and, so far as I can see, there is nothing in the natural history of man or in the special natural circumstances and history of these persons that will explain or account for the seizure and its complex of peculiar features. The typical sporadic recurrence of experience of this kind does seem to me to suggest strongly that some non-physical or spiritual agency is at work, an agency extrinsic to the person concerned and not human, whether individual or collective.

Secondly (and here I part company with the great majority of my scientific colleagues) I hold that what is known as telepathic communication is reasonably well established as an occasional occurrence; that is to say, that under conditions not yet definable, one human mind does sometimes influence or communicate with another in some way which science utterly fails to make intelligible. It may be that there is involved some subtle physical medium of communication; but in view of the fact that many instances of seeming telepathy have occurred between persons widely separated in space, it is very difficult to accept any such hypothesis (however plausible it may seem for instances occurring between persons at close quarters). We seem driven to postulate a mode of communication that is independent of spatial conditions and depends only upon mental conditions. If this conclusion were fully and indisputably established, it would at once give strong support to that view of prayer which regards it, not merely as a process of personal expres-

sion and refreshment, as self-suggestion or soothing contemplation and encouraging reflection, but as a process of communication between one Spirit and another in some super-physical fashion. And a supplementary deduction would be the human mind's relative independence of the bodily organization, and hence support for the view that Mind in general is not closely tied to, or strictly limited in its operations by, any physical conditions.

Thirdly, I go still further in this highly disputed and disputable, not to say disreputable, direction. I hold that the labours of the English Society for Psychological Research, sustained for fifty years in heroic fashion, have brought together a mass of evidence which, when impartially considered (as it so seldom is), confronts us with the following dilemma: *either* "telepathy" operates in a most far-ranging manner, emanating from or exploring and tapping the most secret recesses of what we call the memory of this and that man, regardless of space and time, *or* something of human personality may, and in some cases does, survive the death of the body. Either alternative, but more especially the latter, would imply that superiority of Mind or Spirit to all physical conditions, which is a fundamental assumption of Theism.

Fourthly and fifthly, returning to less controversial ground, I find two peculiar capacities of the human being that seem to defy all attempt to regard them as naturally engendered, as having been produced by those evolutionary processes that do seem (more or less) capable of having engendered all other human

powers from such rudiments as we find in the animal world.

One of these is the mathematical capacity. If we see a dull boy labouring with the principles of elementary arithmetic or geometry or algebra, his mathematical capacity inspires in us no respect and no wonder. But sometimes we find a boy, in all other respects dull and commonplace enough, who displays a most astonishing and wholly inexplicable capacity to solve (to return true answers to) almost instantaneously, most difficult arithmetical problems, such as extracting the cube roots of high numbers or raising numbers to the n th powers. In some such cases a quite unusually vivid visual memory seems to be involved. But in some cases even the assumption of such memory raised to an unknown degree of vividness and accuracy leaves the achievement utterly inexplicable. And, mysteriously enough, this strange capacity in some cases fades away, as mysteriously as it came, leaving its erstwhile possessor a very ordinarily endowed human being. Put alongside these facts the facts of mathematical genius of a high order, such as that of Pascal, of Newton or of Kelvin, and the problem assumes deeper mystery and deeper significance.

That the human race should have evolved from its ancestral foundations of animal capacity the power of simple counting, measuring and calculating seems of no exceptional significance. Such powers are of obvious biological utility; and, if the Lamarckian principle be valid, may well have improved greatly through use in the civilized races of mankind. But neither natural selection nor the Lamarckian principle can in the least account for the genesis of either the talents

of the calculating boy-prodigies or mathematical genius. Can we be content to regard them as chance by-products of the evolutionary process? Power of this kind, sporadically manifested by a few human beings, suggests strongly that Mind or Intellect existed full-blown before the evolution of the human brain, and that brains are but instruments which permit in various degrees some partial manifestations of the full range of intellectual power.

An allied indication is afforded by the fact that most men seem to be furnished by "Nature" with a larger amount of brain-tissue than they ever succeed in bringing into effective action during their lives. There would seem to be no possibility of finding a purely "natural" explanation of this state of affairs. It would seem that the evolution of the brain has been pushed beyond the point that would serve for all present uses, in anticipation of, or in preparation for, some higher development of intellectual power that lies still in the future, the realization of that potentiality being perhaps rendered impossible at present through lack of development of other organic functions.

Lastly, I find in man's response to beauty something that seems beyond the scope of "natural" explanation. Grant that some animals respond to bright colour patterns and to some simple sequences of tone, in a manner that implies that they find them pleasant; grant that such appreciation may have proved useful and may have been developed through "sexual selection"; grant also the validity of the Lamarckian principle, the working of which might be supposed to have

rendered the race of man increasingly disposed to respond positively to such things as smiling landscapes, gentle voices, well-formed bodies and faces expressive of health and vigour; I still cannot see how we can "naturally" account for the profound and overwhelming effect of beauty upon many men, whether in the form of landscapes, of the human face, of music, of words, or of representative art. The most widely accepted psychological theory is that in all cases we have to do with a sublimation of the energy of the sex-impulse. There is no doubt some truth in this theory; but it seems very inadequate in face of the profound effects on some men of the beauty of nature, the effect for example of a grand tropical sunset. And even in respect of that form of beauty to which it is most obviously applicable, the beauty of the human form and face, the theory seems wholly inadequate. It seems to be true that, the more beautiful the human form, the more strongly does it evoke the sex-impulse in the observer; and it might even be said that this is the essential condition of his finding it beautiful. So far the "natural" explanation seems valid. But beautiful form goes far beyond the mere evocation of the sex-impulse. It evokes also very different tendencies which hold the sex-impulse in check, and, in so doing, lead to its sublimation. And this is not, as the Freudian theory assumes, merely a consequence of social discipline. It is rather a perfectly spontaneous mode of response. Sublimation is, no doubt, involved in the process; and probably all esthetic appreciation implies some such balanced opposition of mutually restraining tendencies. But what remains inexplicable by the theory is the powerful evocation of these re-

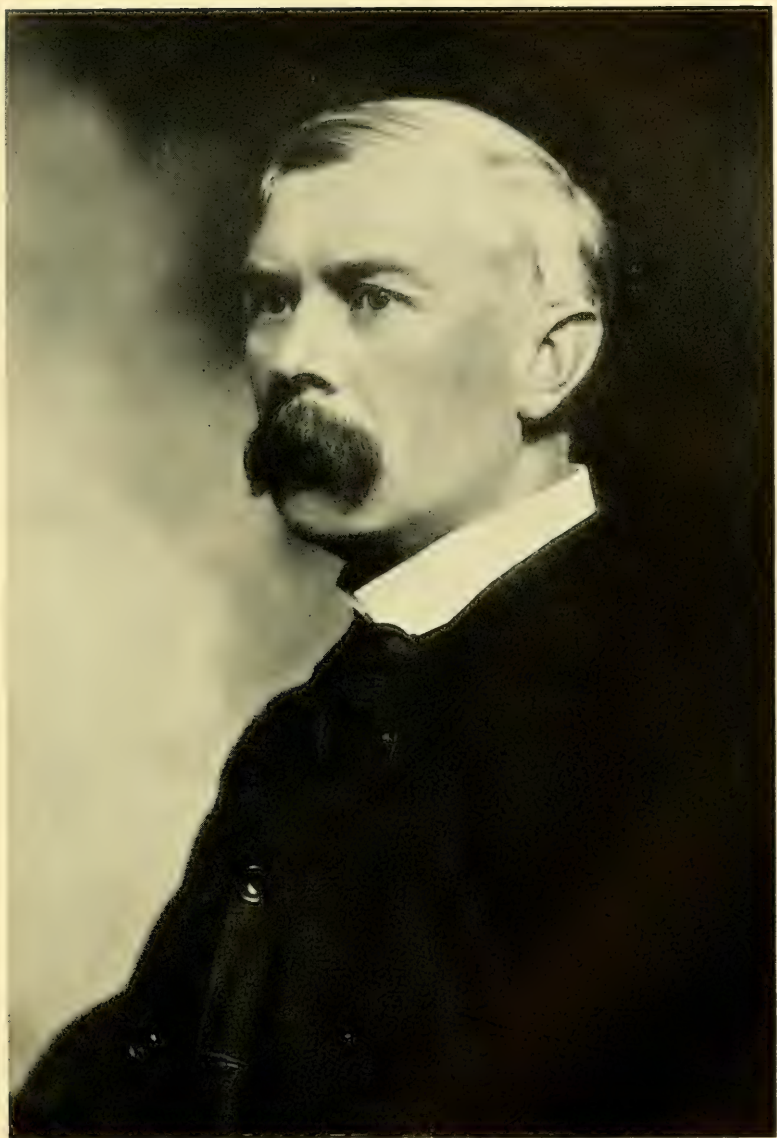
straining tendencies and the transmuting of the whole system of energies to a new plane, a plane on which the man is, and feels himself to be, living among immortal and ineffable realities.

Not where the wheeling systems darken
And our benumbed conceiving soars!
The drift of pinions, would we hearken,
Beats at our own clay-shuttered doors.

HOW SCIENCE CHANGES OUR VISION
OF GOD

SIR J. ARTHUR THOMSON

SIR J. ARTHUR THOMSON received his education at the universities of Edinburgh, Jena and Berlin. He has been lecturer at the School of Medicine, Edinburgh; was Gifford Lecturer at St. Andrews; Terry Lecturer at Yale University; and Morse Lecturer at Union Theological Seminary, New York City. He has issued many publications. Among the best known may be mentioned: *The Bible of Nature*; *Darwinism and Human Life*; *Secrets of Animal Life*; *The Gospel of Evolution*; *Modern Science*; and *The Outline of Science*. Both Edinburgh and McGill Universities have conferred on him the degree of LL.D. Dr. Thomson has been interested in the implications of religion in the field of science for more than twenty years. He has written and lectured widely on the subject. At seventy years of age he contributes this discussion out of a life filled with continuous study, observation and reverence for the marvellous beneficence and sequence he has discovered in the cosmic order.



X

HOW SCIENCE CHANGES OUR VISION OF GOD

By SIR J. ARTHUR THOMSON

FROM time to time the progress of science has made the world new to man. Thus, to take a familiar case, the scientific world became new when the Copernican doctrine prevailed and it was recognised that the earth revolves around the sun, and not *vice versa*; that our solar system, in other words, is heliocentric not geocentric. Or, again, the world became new when Newton linked the falling apple to the passing moon, and stated his universal Law of Gravitation, which not only unified the cosmos, but freed vast stretches of it from all thought of caprice. It was a breath of this new world with its "reign of law" that led the caustic poet to ask: "Shall gravitation cease when *you* go by?" Another new world emerged when it was realised that in ordinary terrestrial operations, no matter is ever lost, though it may entirely change its guise. To Lavoisier's measured demonstration of the Conservation of Matter, Joule and others added the great generalisation of the Conservation of Energy; and the scientific world became new afresh. From this there has been no relapse, though the two ideas of conservation are nowadays subsumed in one, and though certain modifications have necessarily followed recent discoveries like radio-

activity. For it is characteristic of sound science that the new does not usually disown the old, but rather develops out of it, sometimes with a gradual progress, comparable to the building-up of the chick out of the egg, sometimes with a sudden metamorphosis, comparable to the transformation of the caterpillar into a butterfly. For ordinary operations it remains true that neither matter nor energy can disappear; and the original doctrines of conservation have not been in essence changed. Rutherford has succeeded in knocking hydrogen nuclei out of nitrogen, using alpha particles of radium as his projectiles, but this does not mean that anything has been magically created out of nothing; and even if it be true that a mutually fatal collision of an electron and a proton gives rise to a radiation, this does not mean that any energy has magically disappeared.

Our point is simple enough, that the world became scientifically new when it became certain that in all ordinary operations, however drastic the changes may be, the amount of matter remains constant, though its form may entirely change; and this idea became a very vivid one when Liebig demonstrated the Circulation of Matter,—that particular elements are ever changing their partners in a ceaseless cosmic dance, so that we picture a nitrogen cycle, a carbon cycle, a sulphur cycle, an iron cycle, and so on, all the world over, forever and ever, until changes cease. Similarly, the idea of the Conservation of Energy became more graphic, when Faraday and others demonstrated the transformability of the different forms of energy. Thus the waterfall turns the wheels which generate electricity; and this is used to warm and illumine and

do work, including in work the capture of the free nitrogen of the air, which serves as a basis for artificial "fertilisers," these being utilised in turn to increase the yield of the wheat fields and thus the bread of life!

Many of us have enjoyed on a holiday the experience of seeing a familiar countryside in a new light,—say at earliest dawn, or in moonlight, or under a veil of snow. We notice features that we never noticed before, new beauties, subtleties, values. In the new light there is often something approaching a transfiguration. And so it is with the world in the light of a new scientific generalisation of the first magnitude, the best example being the change of outlook implied in evolutionism. In a deep sense it is true that Darwin's voyage on the *Beagle*, when the idea of Organic Evolution began to possess his mind, was a Columbus voyage, discovering a new world—a world not only evolved, but evolving. Men began to see everything as part of a world-wide process of Becoming. Everything, as Bagehot put it, became an antiquity—the long result of time; yet in another aspect the cosmic process stood revealed as an æonic succession of novelties, as a long-drawn-out sequence of new creations. The evolutionist outlook is essentially kinetic, the old order changing and giving place to the new; and many of the novelties, such as domesticated animals, cultivated plants, and man himself, are obviously teeming with possibilities of newnesses in store. Every one knows how the naturalist's new view of the world of organisms was associated with the geologist's picture of the gradual differentiation of

the earth and with the cosmologist's nebular hypothesis of the making of worlds, and how every order of facts—even the story of the Mind itself—became new in a new light.

So far then our first proposition: which amounts to this, that from time to time the advance of science has given mankind a new world, as may be illustrated by thinking of what we owe to Copernicus, Newton, Lavoisier, Joule, and Darwin. The newness may be a fresh orientation, as in the change from geocentric to heliocentric, and from fixity to flux of species; or a new orderliness, such as was formulated in the Law of Gravitation; or a new unity, such as that revealed in the modern theory of the chemical elements, which differ from one another in the numbers, arrangements, and movements of their component electrons and protons; or in the discovery of new chains of causes, such as the establishment of stellar systems from nebulae, the origin of planets from a sun, the emergence of new kinds of living creatures from simpler ancestors, and the correlation of "the secret motions of things," as Bacon phrased it, to yield a resultant visible activity.

One of the most impressive of all scientific diagrams is that which shows in measured proportion all the known electromagnetic vibrations, or "ether-waves," from those of huge wave-lengths, used in broadcasting, to those of very short wave-lengths, used in radio-therapy. If we count the various rays included in humanly-visible light as one octave, there are sixty-one other octaves in the long gamut,—from gamma rays to ultra-violet light, and from heat rays to Hertzian,

not forgetting, towards the lower end of the scale, the mysterious cosmic rays discovered by Millikan. Now all these are of the same nature; they are electromagnetic vibrations, all travelling in space with the same velocity of 186,300 miles per second. This means not only a remarkable unification of the radiant energies; it means that the powers of the world have become more intelligible by being ranked in a series; and it means, as we all know, a great increase in man's practical mastery or control.

SCIENCE AND BEYOND SCIENCE

Science aims at an analytic and genetic description of the world and of all that goes on there, in so far as scientific methods can be applied. It is not the only kind of knowledge; it is partial and abstract, for it deliberately restricts itself to verifiable factors that can be measured or registered, observed again and again, and even experimented with. We all know our friends more or less well, and our parents, in most cases, very well, but real as this knowledge is, it is not in the main scientific. It is reached by personal experience and mainly along the pathway of feeling. It is reliable knowledge, but it has not that impersonality that is characteristic of science. Thus there are very different appreciations of the same person, while there is only one scientific account of the composition of a chemical substance, and only one scientific account of the structure of the human heart. The more marked unanimity or impersonality of well-established *exact* science is mainly due to the fact that chemistry and physics have not to deal with *individualities*, which

cannot be ignored in the fields of biology, psychology, and sociology; or, to say the same thing in a different way, the methods and concepts of chemistry and physics, mechanics and dynamics, go much further towards exhausting the situation in the domain of things, than they do in the realm of organisms, or in the kingdom of man. But even when the scientific description goes far towards exhausting the situation, it may remain in obvious ways partial and abstract—simply because it is reached by using certain methods and these only. Thus part of the reality of a countryside, to those of us who enjoy it, is the beauty of the scenery, but while this beauty is to us as real a fact as the mineral character of the mountains, it is not realised by us in the same way. The æsthetic emotion, in short, contributes to our total appreciation of the countryside just as legitimately as does our scientific analysis. Science is the only road to accurate description, but the pathways of feeling and of obedience are also rights of way towards reality—towards truth.

We have often used the homely metaphor, that scientific inquiry is like fishing in the sea with certain kinds of net, varying in their size of mesh. But there may be much in the sea of reality which can never be caught with gear and tackle of the scientific type—measuring, weighing, enumerating, analysing, and so forth. Yet we may come to know these treasures of the deep in other ways! It was a wise man who said: *Nur was du fühlst, das ist dein Eigentum* (Only what you *feel* is your very own). And there are other riches of wisdom, in regard to which we can only say: *Vivendo discimus*. Obedience is a pathway, to “knowing the doctrine.”

Science may be defined as a criticised and systematised body of verifiable knowledge, based on observation and experiment, and summed up in the lowest common denominators available at the time. Thus at present the scientific formulations, whether descriptive of states of Being or of processes of Becoming, are in terms of Matter and Energy, Life and Mind. More definitely expressed, the present-day Lowest Common Denominators are Electrons, Protons, Radiations, Protoplasm, and Sentience or "Mind." Science, truly so-called, is always impersonal, that is to say it is verifiable by all normally constituted minds who can use the methods. It is indispensable and irreplaceable, and it includes all orders of facts to which scientific methods can be applied—but the degree of its exactness varies with the degree of exhaustiveness attained for the time being by these methods. Thus the present-day science of dreams is very inexact compared with the science of astronomy, and the science of psychology is less exact than that of physiology.

It may seem strange to speak of the unanimity and impersonality of science, when even the man in the street is familiar with the echoes of scientific controversy. But most of these controversies have to do with what is still very young science, or with domains where the rigorous application of scientific method is difficult, or with cases where the scientific summing-up has not reached scientific precision, as may be illustrated by hasty presentations of the Darwinian doctrine of the Descent of Man. Often, of course, the controversy is not a scientific controversy at all, but a thrust and parry between a hasty scientific generalisation and an unplastic theological conviction.

To be guarded against is a too ready acquiescence with the widespread view which regards science as a bedrock kind of knowledge, deeper and surer than all other attempts to understand and appreciate. When a conclusion has once passed the tribunals of science, both in idea and in formulation, it is reliable down to the ground until some new discovery demands a change of statement, and even then it is usually a subsuming, not a recantation, that is required. There are no alternatives in concrete scientific description at any given time. But this is not to say that the only way of trying to appreciate a given set of phenomena is by scientific methods. As we have already said, science is admittedly and deliberately partial and abstract; there are other lines of approach. Therefore when the matter-of-fact man inquires: "What has Science to say about it?", he is asking a necessary question—would that it were oftener put, but he is deceiving himself if he thinks that the scientific answer is the last word on the subject.

This brings us to the important position, that Science asks: *What is this? How does it keep a-going? Whence came it and by what factors did it come to be as it is? What is it leading on to?*, but never asks *Why is this? What is its meaning or purpose?* This last question—the deeper *Why?*—is quite beyond the métier of Science. Science cannot answer it; indeed it never asks. Yet the question is for most minds irrepressible, and answers come from the reflections of the philosophers or from the more naïve interpretations of the religious mind.

Science aims at a *description* of things and processes

in terms of the Lowest Common Denominators available, while Theology and the intellectual activities of Religion aim at some transcendental *interpretation*, in which the highest concept is that of a Supreme Spiritual Reality—God. Between the scientific description and the religious interpretation there should be no antithesis, for they belong to different universes of discourse, yet they must be consistent, for we cannot tolerate idea-tight compartments in our minds. Thus there arise such questions as this article raises: how our theological or religious ideas must undergo some modification as science advances. This is surely as it should be if the world is in any sense God's handiwork.

RELIGIOUS AND SCIENTIFIC IDEAS

Along various paths, some of pain and others of joy, some of strenuous effort and others of open-heartedness, men have had glimpses of God, as who should say. Sometimes from the heights and depths of his ethical life, sometimes from the book of history, at one time from the lives of prophets, priests, and kings, or again in the example of noble women, there has come to man some vision of a spiritual reality behind all mundane happenings. Even if he cannot pretend to understand the Divine Purpose, there is steadying in the belief that some Purpose there is.

From the history of religions it is plain that religious activity may be *intellectual*, as in a thought-out theodicy, or *emotional*, as in sacred music, or *practical*, as in offering propitiation or doing penance; and that all forms have this in common that they make an

appeal to mystical realities beyond the horizon of everyday experience. Tendrils of some sort are sent out into an Unseen World, very crudely pictured to begin with, but becoming in the course of ages, less magical and more mystical, less anthropomorphic and more spiritual. On man's side the common feature has always been straining at a limit—of intelligence, emotion, or practical endeavour; and these limits remain to-day as the springs of religion. Most men still feel that they cannot "make sense" of the world and their place in it without some religious belief, such as faith in a Divine Purpose, while others cannot hold the cups of feeling, whether of joy or of sorrow, without trembling with religious emotion. Man's mastery of natural forces has increased so greatly in civilised countries that the practical pathway to religion is not much frequented to-day, except by those who take seriously the problem of living a good life. On the whole, however, it remains true that religious activity consists of tendrils—intellectual, emotional, and practical—which man sends out towards the Absolute; and the fact that some people find no need of these may not mean much more than that some people are colour-blind, and others tone-deaf, and others immune to poetry. At a higher level, no doubt, are those brave spirits who occupy a determined Positivist position—the clear-headed lovable Sadducees of to-day.

The idea of God is or should be the highest expression of man's mind, and it is a fact of history that it has been from time to time refined and enlarged with man's increasing understanding and appreciation of the world, though often it has relapsed again from a

higher to a lower expression. A revelation, to use the old and wise phraseology, has often been appreciated for a time and then become blurred, as when the idea of Creative Purpose led to a very anthropomorphic picture of a Divine Artificer. Theoretically, man's idea of God as Creator should be grander to-day than ever before, for man's outlook on the world is grander; yet in many ways the Nature-Psalmists were a long way ahead of us.

In thinking of man's religious activities as prompted by the strains involved in reaching the limits of ordinary intellectual, emotional, and practical endeavour, we must not fall into the error of supposing that religion is simply a human edifice. For were this the case we should simply be sending tendrils around tendrils. The centre of religion is a belief in a spiritual reality beyond the everyday world, and the largest fact in religious experience is the reward that comes to man when he opens his heart to the Supreme Reality. Beauty is a reality and music is a reality, and their influence is well known; so, all through the ages, man has been rewarded by the beauty, the music, the sunshine of the Supreme Reality to which he opens his heart. The view that this is all an illusion does not seem to fit the facts of history.

An analogy may be useful. Science is a human achievement; the investigator sees Nature in the mirror of his mind; his concepts are of his own making and he uses many devices which are frankly symbols. Thus while an atom has reality, just like a visible particle, since there are devices for demonstrating its path through a particular experimental field, the constitution of an atom, sometimes with an intricate constella-

tion of electrons and protons, is not directly verifiable. Yet even this symbolical picture is not an illusion, since it more or less fits the facts. And it cannot be said to be discredited when it has to be modified to correspond to fresh discovery. It is a mistaken "paradidealism" which depreciates the scientific Laws of Nature because they are obviously man-made, for while they may not be exactly summations of what actually takes place, they bear a more or less close approximation to reality, since they can be trusted to in practice and used as a *basis for prediction*.

All these prolegomena have seemed necessary in order to show in proper perspective the changes in our thoughts of God that seem to be called for by the advances of science, and are indeed more or less rapidly coming about. It will be understood, of course, that other changes are in progress under the influence of a deeper understanding of history, and of a modernised critical philosophy, and through a fresh appreciation of the Gospel of Christ, to which so many transfigurations have been due.

NEGATIVE CHANGES

(a) The advance of science discloses chains of efficient causes, and the First Cause is pushed further and further back. Thus our thoughts of God become less anthropomorphic. Nature is a system greater than our greatest thoughts of it, and this must be even more true of our thoughts of God. We know that *purpose* for one man is a lofty and abstract idea, while for another it may be little more than a commonplace and concrete picture coloured with emotion. To a higher animal purpose may be often no more than a revived

mental image, backed by appetite. Thus we realise how stammering we are bound to be in speaking of the Divine purpose. And so with all our words.

(b) One of the great facts of life is its adaptiveness. Every complicated living creature is a bundle of fitnesses. Take away all the adaptations from a whale, and what is there left? An enthusiastic recognition of this characteristic adaptiveness of organisms by the naturalists of Paley's day led to the famous argument from design. The world of life declares the skilful hand of a Divine Artificer. A watch proves a watch-maker, and the eagle in the air is God's handiwork.

But when Darwin made the evolution-idea current intellectual coin, and when he disclosed the verifiable factors by which adaptations have been in the course of time wrought out and perfected, then Paley's proof of the direct action of a Divine Artificer became unconvincing, and a somewhat uncouthly materialistic picture had to disappear. In our judgment, this was great gain,—especially when the Paleyan idea was replaced by a larger teleology, the idea of a Creative Purpose which so endowed the primary irreducibles that the first organisms included for all their descendants the capacity of evolving fitnesses by means of such verifiably operative factors as variability, heredity, and selection. There is a deep truth expressed in the title of the best of all recent introductions to the study of Organic Evolution—Mrs. Frances Mason's co-operative book: "Creation by Evolution."

(c) Very characteristic of the progress of science are its unifications. All the known chemical elements are built up of electrons and protons; all the different

radiant energies are on one gamut; matter itself seems to have been swallowed by electricity. Einstein is bringing gravitation into line with the radiant energies. In any case there is general agreement that the physical Lowest Common Denominators of the Universe may be conveniently stated as matter and radiation, alike passing through space, or as matter and ether-waves. It is a big thought that the wondrous fabric of the Universe is fashioned out of three or four kinds of thread: matter, radiations, life and mind.

Perhaps there is a tendency to over-emphasise the unification, for there is much to be said for recognising not one Order of Nature, but three orders of facts—the domain of things and forces (the cosmo-sphere), the realm of organisms (the biosphere), and the kingdom of man (the sociosphere), for each of these orders of facts has categories of its own, and each of the three great sciences, Chemo-Physics, Bio-Psychology, and Sociology, has its own autonomy. Yet the scientific unification that has been achieved is worthy of being called epoch-making.

Now along this line of thought we come upon the suggestion that God is to be thought of as the summation of all the powers of the Universe. Sometimes the suggestion goes the length of saying that God is the sum of all the energies. In our judgment this is a line of thought that does not lead to progressive change. For while there can be nothing in the world that can exist apart from God, and no power that is not ultimately His, the generalisation is an attempt to speak two languages at once. "Energy" is a physical concept and measurable; God is a transcendental concept, of the Supreme Reality, and infinite. A summa-

tion of all the physical energies would still be physical, whereas, in the words of the catechism, "God is a Spirit, infinite, eternal, and unchangeable in His Being, Wisdom, Power, Holiness, Justice, Goodness, and Truth." The search for a finite God has not justified itself in the past: *un Dieu défini, c'est un Dieu fini*.

(d) Science reveals the orderliness of Nature, showing that everything is under "the reign of law." Thus the world has become more and more intelligible, and the extent to which this has been achieved is a fact that must be appreciated in a synoptic or philosophical view of the world. Science has a long way to go, but *the fact of science*, impressive even in its imperfection, must be taken account of and included in the philosophical or religious outlook. . . . To many minds it seems in itself indicative of a Divine Purpose.

The scientific formulation of Laws makes the world more intelligible, but it must be understood that the old view of Natural Laws as having some compelling power of enforcing obedience was a confusion of thought. It persists in such phrases as "obeying the Law of Gravity," but it has been replaced by the understanding that a scientific "law" is the investigator's terse formulation of uniformities of sequence, and that it describes without "explaining" in any deep sense. The only scientific "explanations" are those that we give when we say: This or that phenomenon is an illustration of, say, Laws III and VII. We clear up an obscure occurrence by showing that it is due to powers or processes that we are familiar with in other connections. A natural law enables us to say: "If this, then that"; but in the long run it merely formulates events in terms of uniformities established in re-

gard to what are, for the time being at least, unexplained irreducibles, such as electricity or protoplasm. Thus it seems to us very doubtful if we gain anything by continuing to quote the old astronomer's saying that the Laws of Nature which he studied seemed to him to be the Thoughts of God. Moreover, most of the scientific laws are only tentative and provisional formulations, trustworthy approximations to reality, but still only approximations. It may seem a strange thing to say, but there is reason to doubt whether we know as yet more than a very few of the Laws of Nature. In other words, most of our Laws, useful, reliable, and illuminating as they are, will require re-statement as analysis becomes more penetrating.

POSITIVE CHANGES

The greatest change in the modern vision of God, a change for the better, though with a tax to pay, is due to Darwin, who, more than any one else enabled man to realise the Creator as the Author of Evolution. Nature and Man are long results of time, not the finished outcome of a creative fiat. Both are still to be regarded as expressions of the Divine power, or will, or purpose; but they have been wrought out in the course of long-drawn-out processes of evolution, whose operative factors can be in some measure discerned and understood. Modern science starts with an Institution of a primary Order of Nature, necessarily unaccounted for scientifically, though well deserving the old name Creation; but from that relatively simple beginning, say a Nebula, there has gradually arisen all the glory of the heavens and all the wonder of life. Whatever be the first picture that we

can scientifically imagine of the Universe a-making, we have no reason to think for a moment of Chaos, if that implies disorder. It is time that the phrase "a fortuitous concourse of atoms" was forgotten, for it never had any reality. Moreover, when we make our first picture we must include in it the promise and potency of "Mind" or "sentience," for there is no possibility of juggling "mind" out of "matter," were it only for the reason that "matter" is only known to us in the mirror of our minds. Mind and Body, psychical and physical, psychosis and neurosis, the subjective and the objective life are incommensurable aspects of reality.

There is something very grand in the conception of a Creator who originated Nature in such a way that it worked out His purpose: an orderly, beautiful, progressive world of life with its climax, so far, in Man, who echoes the creative joy in finding the world "good." The philosophical astronomers have been telling us that the cosmos looks like the expression of a supremely mathematical Mind, but the biologists have also their contribution to make to the vision—a glimpse of a Creator who loves life for its own sake, and is not unwilling to let a million years go to the fashioning of an eagle's pinion. It is not merely that the world of life has evolved, for so have the large classes of sponges and of fungi; the big fact is that the evolution has been on the whole integrative and progressive, showing from age to age an emergence of finer organisms, with greater fulness and freedom. The largest fact in Organic Evolution is the growing emancipation of the mental aspect of life, for so long sleeping and dreaming, but gradually passing from sen-

tience to intelligence, and finally to reason in Man. As Lotze said, there is in Organic Evolution "an onward advancing melody."

DESCRIPTIVE NATURALISM

It seems very unlikely that scientific method will ever go back from the descriptive naturalism which has become one of its characteristics in modern times. That is to say, science seeks to describe the nature, continuance, and history of what it studies in terms of factors which are experimentally verifiable in the systems observed. It cannot dogmatically say, of course, that it has an exhaustive knowledge of these resident factors, but it must do its best with what it knows; and when that affords a basis for prediction, it is safe to say that there has been some approximation to reality. But an adherence to the aims and methods of *descriptive* naturalism does not mean any dogmatism as to *interpretative* naturalism. To answer the scientific question "How?" in terms of empirical naturalistic factors—the Lowest Common Denominators available—does not preclude trying to answer the religious question "Why?" in terms of mystical or transcendental factors—the Greatest Common Measures we can think of. Of which the greatest is the idea of God. Thus at one time we may seek to analyse the biological and psycho-biological factors that have operated in the Ascent of Man, while at another time we may seek to interpret Man as an instalment of the Creator's purpose. The tax on scientific evolutionism is that it leads some minds to banish God from His universe. For the apparent satisfactoriness of the inquiry into immediate efficient causes leads many to

ignore the implications these involve, as well as the question of purpose which they necessarily ignore.

Darwin's magnanimous colleague, Alfred Russel Wallace, went beyond Biology and beyond science when he postulated special "spiritual influxes" to account for various "big lifts" in evolution, such as the emergence of man. He thought that without some such postulate the outcome could not be accounted for in terms of the pre-conditions, but his postulate was a departure from the method of descriptive naturalism which keeps to empirical formulæ. Thus the biologist in trying to account for the facts of life keeps to the verifiable factors that are known to be resident in organisms and their surroundings. These factors include:

(a) Chemical and physical processes, operative in and around organisms;

(b) Qualities of protoplasm that remain in greater part (at present) irreducible, such as irritability, vital persistence or inertia, growth, development, and variability;

(c) Resident mental or psychical activities, when these are convincingly recognisable as operative.

Only when the biologist has exhausted the potency of these verifiable resident factors, is he at liberty to say that this or that fact of life cannot be scientifically accounted for. He must therefore remain radically opposed to every attempt to eke out empirical factors with subsidies from transcendental treasuries.

Thus the evolutionist vision sees a Creative Purpose that so endowed the primitive irreducibles that the first organisms included for all their descendants freedom

to evolve in a progressive way, expressing, without subsequently interpolated direction, more and more of the riches of reality—a process of evolution that is still going on. This wider concept of Creative Design is expressed in the words that Charles Kingsley, in his “Water Babies,” put into Dame Nature’s mouth, as she sat with folded hands, so puzzlingly at leisure: “You see, I make things make themselves.” Thus did the genius of the Creator save the evolving world from the shackles of determinism—leaving room for the freedom of individuality, and yet secured the climax in the first act of the drama. But this view has to be philosophically and religiously combined with the belief that created Nature, though superficially sufficient unto itself, is never out of the thoughts of Him in whom, in some inconceivable way, it lives and moves and has its being.

THIS CREATIVE HUMAN SOUL

MICHAEL PUPIN

MICHAEL IDVORSKY PUPIN was born in Idvor, Banat, Hungary, in 1858. He holds an A.B. degree and a Sc.D. degree from Columbia University, a Ph.D., from the University of Berlin, and an LL.D. from Johns Hopkins University. He has been Professor of Electro-Mechanics at Columbia since 1901. He holds membership in several engineering and physical societies. Among his best known books are *The New Reformation*, and *From Immigrant to Inventor*. It is not generally known that Professor Pupin, to a considerable degree, started Robert A. Millikan on a scientific career. While at Columbia Millikan studied physics with Professor Pupin, whom he describes as the most inspiring man he ever met. Michael Pupin commenced his career in America as a Serbian immigrant. He is closing it as one of the most distinguished scientists and thinkers in the country. It is estimated that his discoveries in the way of more economical mechanical handling have saved telephone companies \$100,000,000.



XI

THIS CREATIVE HUMAN SOUL¹

By MICHAEL PUPIN

IN the inorganic universe we know the structure of the co-ordinators and many details of their co-ordinating functions; in the organic, however, we do not know them. We know the results of their operations, but we do not know the various co-ordinating steps which lead to this result, not even in so simple a process as fermentation. We cannot say, to-day, that these steps are of a purely mechanical nature, as in the case of the inorganic universe, nor can science deny it.

Suppose, however, that some day we do succeed in demonstrating that the co-ordinators in the molecules of life and in their cellular microcosms are physical structures similar to, and operating in ways similar to, those in the organic universe, that will not mean a victory for the mechanistic view of life. There will still remain the mystery of the living soul and of its internal world, particularly that of the living soul of man. Can the language of science describe the creative process which brings this internal world into existence without employing the vocabulary of speculative philosophy?

¹ From *The New Reformation*. Copyright, 1924, 1926, 1927, by Charles Scribner's sons. By permission of the publishers.

Our mother earth is a tiny dust speck in the material universe, but as the home of the creative soul of man it becomes the crown of creation. The life of man is, as far as we know, the highest product of creation, and it is the most precious gift of heaven. Its broadest aspect is co-ordination, which eliminates the chaos from the activities of its countless molecules of life, and constructs the cosmos, the presence of which we feel in the internal world of our creative soul, our consciousness. In the language of science it might be described as the climax of creative co-ordination. Its cosmos is probably the ideal cosmos which the poets of ancient Greece had in mind when they represented it as the creation of the Olympian gods.

No scientist can contemplate the mighty theme, the life of man, without pausing reverently and recalling Tennyson's well-known lines, dedicated to a tiny flower plucked from the crannied wall:

I hold thee here, root and all, in my hand,
Little flower—but if I could understand
What you are, root and all, and all in all,
I should know what God and man is.

No words of mortal man can describe more beautifully the mystery of organic life. Can the knowledge for which Tennyson was yearning be advanced even a tiny bit if the life of man is viewed in the light of the cosmic processes of creative co-ordination? Such an attempt is not without some promise.

Paderewski's vibrating fingers speeding along the keyboard like electric waves through quiescent space arouse my emotions, and I wonder at the harmonious response of the billions and billions of organic cells to

the co-ordinating physical processes which animate Paderewski's ethereal touch. But my wonder is amplified a thousandfold when I listen to the tuneful message which this performance of perfect physical co-ordination conveys to me from the internal world of Paderewski's consciousness, where it was recorded by the creative soul of some heaven-born genius.

I cannot resist, then, crossing the boundary-line which separates the external material world from the internal world of my consciousness. Here I find a power which is at work creating this *internal* world. This power is a manifestation of a new entity in the existence of which mankind always believed and called it the soul of man. This belief is the essence extracted from all human experience. No physical reality rests upon a broader and deeper foundation of experience than this belief. The soul is the creative co-ordinator residing in the body of man and guiding its functions so as to make the life of man a cosmos, a creation of simple law and beautiful order. Our belief in the existence of the creative soul is the origin of our belief in the existence of a Creator.

Our present knowledge, derived from man's experience ever since he began to live a human life, rejects the hypothesis that the creative power of man's consciousness is the highest form of creative co-ordination; it demands a still higher form of creative co-ordination. The creative power residing in us is, therefore, the origin of the belief that our creative soul is a part of Him who endowed the electrons and protons, the atoms and molecules, and the tiniest units of living matter with those primordial attributes which

manifest themselves in the cosmic processes named creative co-ordination.

Never did man exhibit more clearly the divine origin of his soul than when he began to recognize that his life is a part, only, of a much more complex and significant life, the life of humanity, the life of an enormous number of autonomous individuals each facing daily the struggle for existence. To guide this complex life from a threatening chaos of a non-co-ordinated humanity to a social cosmos became then the highest problem of man's creative soul. The gradual solution of this problem is the evolution of social co-ordinators, which promised to lead humanity to a social cosmos.

Church and State are the most important among the social co-ordinators; they are, like the physical structure of the human body, physical structures only, employed in co-ordinating operations. But just as the human body becomes a living soul when it is animated by the divine breath of its creator, so the same divine breath must give to Church and State a living soul which will guide their operations and put into them the power of that creative co-ordination which will lead the life of humanity to a cosmos. That soul is the co-ordinated effort of our individual souls, guided by the highest ideals of spiritual achievement. Without such efforts the life of humanity will never rise to the full glory of a social cosmos, and the individual life of man will lose many blessings to which it is entitled by its close relationship to the divinity of the Creator, the fountain head of all spiritual realities.

Just as the cosmic processes of creative co-ordina-

tion guide the evolution of the external material world, so creative co-ordination also guides the evolution of the internal world of the human soul, the destiny of human life.

This is my message from science.

In my boyhood days I often put two questions to myself. One question was: What is sound? The other: What is light? A search for an answer to these two questions directed my scientific career.

What is sound? This will prepare us for my answer to the second question.

When the clapper strikes the church bell the bell vibrates and transmits its vibration to the air. The sound waves in the air, spreading out in every direction, reach the listening ear, and convey to the enquiring mind of man the following simple story:

The collision between the clapper and the bell puts energy into the bell, and, feeding upon this energy, the bell becomes a living thing. Its life manifests itself through its vibrations, which are in harmony with its structure. Neither the clapper nor the power which moves it can change the character of these vibrations. They are the result of the elasticity and the destiny of the material of which the bell is made, and of its form which the designing intelligence of the bell-maker gave it.

But does this story give us a complete description of this familiar illustration of sound generation, transmission, and perception? No, it does not. It says nothing about the message which the bell is conveying to our souls. To get this part of the story we must follow the vibrations in their passage through that

marvellous receiving instrument, the ear, which, with its sixty thousand parts, is busy speeding the message along millions of tiny nerves to the central station, the brain. There the soul of man interprets the language of the bell.

This second part of the story of the bell tells me that the vibrating bell is a small link only in the endless chain of phenomena which connect the external physical world to the internal world of our soul, where the message of the bell is deciphered. The more I study this second part of the story of the bell the more I recognize to-day that my boyhood fancy was right when on the pasturelands of my native village it led me to imagine that the faint sound of the distant village clock was a message from God.

I never listen to the melodies of Kreisler's violin without recalling to mind this message of nearly sixty years ago. To me Kreisler's violin is a bell. The smooth and silent movement of his bow communicates to the strings a rapid succession of tiny pulses identical in action to the strokes of the clapper upon the church bell. They are tiny but numerous clappers which impart to the strings the energy of their life. This life manifests itself in their melodious vibrations, carrying a wonderful tale to our listening soul. The tale is identical with that which I mentioned in my description of the language of the church bell. But one essential difference must be mentioned. The violin-maker, just like the maker of the church bell, imparts to the bell, called the violin, its fundamental character. The virtues of a Stradivarius are among the glories of human ingenuity. But the temperament and skill of a Kreisler superpose upon this funda-

mental character of the violin an almost infinite variety of modulations.

Kreisler makes the vibrating strings speak a language which is indeed a message from heaven. When Kreisler plays a Beethoven sonata he is the apostle of the great composer and delivers his master's message. The message is the embodiment of an inspiration, the cradle of which is the soul of the heaven-born genius.

Such a message is a message from divinity, and it recalls to my memory the vesper-bell of my native village and my mother's words, "Michael, do you not hear God's message which calls you to his altar to praise his everlasting glory?"

This is the answer which science gives me to the question: What is sound?

What is light?

This is indeed a momentous question. The sun-worship among the ancients testifies that even without a trace of the scientific knowledge which we possess to-day, the ancients knew intuitively the function of sunlight in all organic life. They knew that without this source of life-giving radiation our terrestrial globe would be a cold and dreary desert.

The greatest glory of science of the nineteenth century is the discovery that light is an electromagnetic phenomenon. To Faraday and to Maxwell and to their native land, the British Isles, belongs that glory. What is the meaning of this wonderful discovery? It is very simple; indeed, it is simplicity itself. A ray of light from our sun or from any hot and luminous body is a swarm of an enormous, practically infinite, number of tiny electrical dots and dashes speeding along

through space like the electrical dots and dashes which the wireless telegraph stations send through space. Each atom and molecule in the blazing sun is a busy radio station sending messages in all directions. These countless dots and dashes tell us that countless tiny electrical clappers are set in motion by the atoms and molecules of the radiating source.

Now what do I mean by that? Consider what you are doing when you are ringing a telephone bell. You transmit a rapid succession of electrical pulses along the telephone wire, that is to say, a rapid succession of impulsive electronic motions. The moving electrons are the electrical clappers. Each moving electronic swarm gives a jerk at the clapper of the telephone bell and makes it strike, the bell responding with a ring. The action of the electrical clappers is thus transformed into the action of a material clapper. The dots and dashes coming from busy atoms and molecules of the sun are a rapid succession of electrical pulses. They, like the electrical pulses which ring the telephone bell, strike the material bodies on earth and communicate to their atoms and molecules the energy of their life. Like the bell on the church spire of my native village, or like the melodious strings of Kreisler's violin, these terrestrial aggregations of atoms and molecules respond and radiate vibrations which are in harmony with their structure. They are the receiving instruments for the messages transmitted by the luminous bodies.

In telegraphy we have a code, that is a certain number of combinations of dots and dashes, each combination standing for a definite word or letter, and the receiving instrument responds equally well to each

combination. In a ray of sunlight there are an infinite number of combinations of dots and dashes, and it cannot be expected that each terrestrial body will respond equally well to every one of them. We can say that the terrestrial bodies are bells, responding best to electrical pulses of some definite form. For instance, this rose responds to electronic pulses which make it sing out, "I am red," and that rose sings out, "I am yellow," when struck by another type of radiant clapper. The lily responds equally well to all of them, and sings out, "I am white." Christ, as quoted by St. Matthew, felt the thrill of a true scientist when, beholding the lily, he exclaimed:

Consider the lilies of the field, how they grow;
They toil not, neither do they spin:
And yet I say unto you that even Solomon in all his glory
Was not arrayed like one of these.

Each tiny flower of the field is a little bell responsive to some solar clappers. And so is the brilliant cloud figure which bids good-by to the setting sun or announces the approach of early dawn. The whole terrestrial globe is a cosmic bell which, responding to the strokes of the solar clappers, glorifies the beauties of our mother earth.

But that is one part only of the message which the sun and the luminous stars are sending to us. Each signalling atom in the sun and in the luminous stars sends us the history of its life and of the life of the star to which it belongs. Listen to a message which the spectroscope reports from a young star somewhere near the very boundary of our stellar system. The message says: "I am a million light years away

from you. I am an astral baby now, and will be a baby still when a million years hence you receive this message. Many billions of years will pass before the ardor of my youth has cooled down to the moderation of your central star, the sun. Heaven only knows when I shall be as old as your old mother earth. But when I reach that age I shall be a beautiful cosmic bell just like your earth and responding to the clappers of the luminous stars, I shall add my voice to the celestial choir which is declaring the glory of God."

This is my answer to the question, What is light?

The answer was prepared in the world of the human soul where a divine power resides, and it recalls to memory the faint strokes of the vesper-bell of my native village of sixty years ago, and my mother's voice saying, "Michael, do you not hear the divine message which calls you to the altar of the Almighty God?"

Creative co-ordination is not a metaphysical abstraction; it is a familiar physical process which meets us everywhere. The steam-engine and the snow-flake; the cycles of the moving water masses which carry their blessings to the thirsty terrestrial continents; the growth of plants and animals—all tell the same simple story of creative co-ordination. It is a physical operation defined in terms of physical laws, and it exhibits a progressive advance from lower to higher forms of orderly structures and functions in the organic as well as the inorganic world; a continuous rise from lower to higher levels.

The beauty of the sunset, a living picture of joy in the world of our consciousness, is the ultimate prod-

uct of a creative co-ordination. The radiation of the setting sun, reflected, refracted, and scattered by matter floating in the atmosphere, is the external source of this beauty. It is an energy chaos, a practically infinite number and variety of electrical pulses sent out at random by the busy solar electrons. These chaotic signals are recorded by our sensations and appear in our consciousness as the beauty of the sunset, a cosmos of consciousness, a creation called into existence by the chaotic energy supply of the external world. This is creative co-ordination which connects the external physical world to the world of our consciousness.

The perfume of the rose, the comforting glow of the log in our fireplace, the ambrosial sweetness of the honey—are all orderly realities of pleasure and joy in the world of our consciousness. But all of them can be traced to the chaotic stimuli of the external world. These few examples suffice to show that chaotic signals convey messages to the living body from its environment, but that each deciphered message appears as an intelligible cosmos in the world of consciousness. There is somewhere in the path of these messages a creative co-ordination which transforms their chaos into an intelligible cosmos of our consciousness.

A part of the co-ordinating transformation is obviously in the physical structure of our body which, like the piston of a steam-engine, averages up the chaotic pulses conveyed through a most complex network of nerves from the external world to the central station, the brain. But the resulting cosmos in the world of consciousness is not that of orderly physical functions like those in the external inorganic and or-

ganic world. It is the cosmos of a state of consciousness. We cannot describe it in terms of any known physical realities; neither can we express it in terms of actions and reactions of any known physical entity. Hence we infer that it is a manifestation of a new entity which we call the soul, just as from the manifestations of electrical and magnetic forces Faraday inferred the existence of new entities which these narratives call the electrical and the magnetic flux.

The cosmos of consciousness is a psychic reality. It is subjective, of course; but it is as real to us as, for instance, the objective physical reality of electrical radiation. Just as electrical radiation reveals the existence of an ultra-material entity, the electrical flux, so the psychic realities of our consciousness reveal the existence of an ultra-material entity, the soul. The ultimate natures of these two entities are hidden behind a cosmic veil which so far has remained impenetrable. Their manifestations, however, are perfectly clear. They are like a living embroidery of supremely subtle texture adorning the visible face of the cosmic veil. But just as Maxwell made many efforts to penetrate deeper into the meaning of Faraday's fluxes, so the many efforts to penetrate deeper into the meaning of the ultra-material entity called soul are perfectly natural. Its meaning interests human enquiry to-day just as much as it ever did since man began to observe and to reason.

But at the very outset of these endeavors the scientist meets a serious difficulty. He immediately detects a fundamental difference between the two ultra-material substances; one of them, the electrical flux, became a dynamically definite and hence perfectly in-

telligible physical entity when the laws of its actions and reactions were formulated in accordance with Newtonian dynamics and verified by electrical radiation experiments. The scientist looks for a similar intelligibility of the other ultra-material substance, and asks: Can a similar statement be made concerning the soul? Is the soul a dynamically definite entity? If it is not, what hope is there for the methods of scientific enquiry to make it so? In answer to these legitimate questions, we certainly can say that the soul acts and reacts; but we cannot say that its actions and reactions, like those of the electrical flux, can be expressed in terms of the Newtonian concepts of actions and reactions.

The following consideration, however, is certainly reasonable: If the soul does not act and react, how does the beauty of the sunset appear in the world of our consciousness; or how do the objective physical realities revealed by science during the last four hundred years, become subjective realities in our sensitive selves? It would indeed be a very great achievement if we could reduce these psychic actions and reactions, the operators of the creative power of the soul, to the simple laws of Newton's dynamics. But why despair if we cannot. The actions and reactions of an individual radiating atom have not yet been reduced to that simplicity; but that fact does not shake any one's faith in the radiating power of the atom. Our faith in the creative power of the soul should be at least as strong, for surely the world of consciousness, the product of that creative power, is at least as real as atomic radiation. The existence of this creative power is the most fundamental human experience

in the course of centuries of centuries, so that to-day it is just as axiomatic as Newton's laws of motion; and it is a sufficient proof of the existence of the soul, although the actions and reactions of the soul are for the present, and probably will remain forever, entirely outside of Newtonian dynamics.

The creative power of the soul is the only guide in our attempts to decipher the meaning of this ultra-material substance. It furnishes the most reliable standard of comparing the soul of one man with the soul of another man, and with that of lower animals. This comparison, resembling, to some extent, the scientific methods of quantitative measurement, has been going on ever since civilization began. The procedure of this enquiry is in many ways equivalent to the scientific method of enquiry by observation, experiment, and calculation: what it lacks in precision it makes up by its vast number of trials and errors extending over many centuries of qualitative measurements by careful comparison. It resulted in the universal verdict, that not only is the soul of man far superior to the animal soul, but that this difference is immeasurably greater than the difference in their bodily structures.

The comparison revealed also an element in this difference which towers high above all the other differentiating elements—it is the *spiritual* element. The creative power of the human soul has created a new world in human consciousness: it is the spiritual world. Perhaps something resembling this spiritual world exists also in the consciousness of lower animals; but if it does there is no unmistakable sign of it in their

conduct. There is, however, one most convincing evidence which speaks against the probability of this existence. *Man worships; animals do not.* Spirituality and worship are inseparably associated according to all human experience. Hence, when man begins to worship, the embryo of the spiritual world began to form in his consciousness. This raised man by leaps and bounds above the level of lower animals. But man's worship is unthinkable without recognition on his part that a creative power exists which is far superior to the creative power of his own soul. This recognition, the offspring of man's experience and reasoning, is the origin of our belief in God, the Creator. The influence of this belief upon the evolution of man's consciousness is beautifully described by St. Paul:

But we all, with open face beholding . . . the glory of the Lord,
Are changed into the same image from glory to glory.

Observation, experiment, and calculation led science to the revelation of new physical realities. This method of enquiry constructed the firm foundation of these realities, a foundation laid deeply in the solid ground of human experience. In a similar way, human experience, derived from contemplation and analysis of the creative power of the human soul, led human reason to a belief in God, the fountainhead of all spiritual realities.

The value of these realities fortified his belief. Their values in every action of human life are felt daily even more deeply than the values of physical realities. All human experience testifies that they are not mere shadows which mislead the untrained imag-

ination. Newton, Faraday, Maxwell, Ampère, and many other great scientists believed strongly in spiritual realities. Have they been led astray on account of untrained imagination? The highest value of the spiritual realities is revealed in the longing of the human soul to rescue the life of humanity from a threatening chaos and transform it into a cosmos, a humanity of simple law and beautiful order, the nearest approach to what we Christians call the Kingdom of God. This longing for the cosmos of simple law and beautiful order in the life of humanity was undoubtedly planted in the human soul by its contemplation of the beautiful cosmos revealed by the realities of the physical world. The mighty oak, for instance, with its millions of leaves inhaling the life-giving energy of the golden sunshine, and with its millions of tiny roots exploring the nourishing wealth of the soil, all co-operating for one common end, is a radiant physical illustration of the cosmos in the life of humanity. Such are the points of contact between physical and spiritual realities which lead us to the recognition of striking resemblances between these realities.

The individual man is a granule in the world of humanity. His relationship to the other granules of humanity and to the physical universe gives his life a definite meaning. This relationship is completely determined by his conduct. If the social cosmos, the Kingdom of God, is to appear on earth, then the conduct of human granules must be guided toward that goal, just as the chaotic vapor molecules are guided by intrinsic forces when they coalesce into the cosmos

of rare snowflake crystals. Creative co-ordination is, therefore, the only process which will lift the life of humanity from lower to higher levels of creation. It is the bridge which connects the world of physical to that of spiritual realities. It is the guide from lower to higher levels in the physical as well as in the spiritual world.

But creative co-ordination is unthinkable unless there are intrinsic forces acting upon the chaotic granules which are to be co-ordinated. History records innumerable evidences which testify that among the co-ordinating forces in the life of man and of humanity the spiritual forces are the most powerful co-ordinators. The similarity between the operations of physical forces and spiritual forces is the second resemblance between physical and spiritual realities.

The testimony of Christ is, according to our Christian belief, by far the most convincing of all the testimonies relating to the co-ordinating action of the spiritual forces. The arguments supporting this belief appeal to our reason with the same force as the arguments supporting a well-established physical theory. Our Christian knowledge of the spiritual forces revealed by Christ is deeply rooted in the solid ground of human experience of nearly two thousand years. It is a house built upon the hard rock of experience, and not upon the shifting sands of arbitrary hypotheses. This knowledge, like scientific knowledge, is the extract of innumerable observations and experiments recorded in the history of human lives. It is, therefore, as carefully tested and as trustworthy as

our knowledge of physical forces. Dealing as it does with the laws of actions and reactions of spiritual forces, it may be called spiritual dynamics.

Christ created it long before Newton had announced his dynamics of matter in motion, Maxwell his electrodynamics, Carnot his thermodynamics or Einstein his relativity theory. These dynamical sciences deal with the physical world; Christ's dynamics deal with the spiritual world. The dynamical sciences of the physical world are naturally incomparably simpler than the dynamics of the spiritual world, but their mutual resemblance both in form and in evolutionary growth is obvious. This resemblance finds the simplest and most striking illustration in the efforts of the spiritual forces to transform the life of humanity into a living structure of simple law and beautiful order. It is here that the mode of operation of the co-ordinating spiritual forces reminds us most vividly of the mode of operation of the co-ordinating physical forces, and this exhibits the most obvious resemblance between physical and spiritual realities.

Our Christian faith sees in the life and teaching of Jesus the highest spiritual reality which our belief in God, source of all spiritual realities, planted in the soul of man. This reality, we believe, endowed our souls with the spiritual forces which guide us in the spiritual co-ordination of each individual life and of the life of humanity. Love, according to Christ, is the most powerful of all these co-ordinating forces. Its action in the spiritual world is very similar to the action of gravitational force in the physical world. Christ discovered it and revealed it to us in His two commandments:

Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind.

Thou shalt love thy neighbor as thyself.

These two commandments are the fundamental law in Christ's spiritual dynamics. It is obvious that under the guidance of this law we can liberate ourselves from the dominating love of purely material things and thus rescue our own individual lives and the life of humanity from the threatening chaos, and transform it into that life of simple law and beautiful order.

Creative co-ordination leads, therefore, to a higher level of creation by the action of spiritual forces, just as it does in the physical world by the action of physical forces. It is the concept of this universal co-ordinating process which unites the two worlds to each other, so that our understanding of one will aid our understanding of the other. The cultivation of this view is encouraged by St. Paul:

For the invisible things of Him
From the creation of the world
Are clearly seen,
Being understood by the things that are made,
Even His eternal power and Godhead.

Yes, God's spiritual realities are invisible; but they are illustrated and made intelligible by the physical realities revealed in the physical things which are made. According to this interpretation of the Apostle's words the physical and the spiritual realities supplement each other. They are the two terminals of the same realities; one terminal residing in the human soul, and the other in the things of the external world.

Here is one of the fundamental reasons why Science and Religion supplement each other. They are the two pillars of the portal through which the human soul enters the world where the divinity resides. If the signs of the time do not deceive then there is a universal drift toward this mental attitude.

This drift I call The New Reformation.

THE HISTORY OF SCIENCE A SEARCH
FOR GOD

JOHN LANGDON-DAVIES

JOHN LANGDON-DAVIES was born in 1897 in Zululand, South Africa. His father was an English clergyman. His grandfather was an electrical inventor. This ancestry helps explain Dr. Davies' interest in science and religion. He was educated at Tonbridge School and at St. John's College, Oxford; and while there held the Sir Thomas White scholarship in modern history, as well as three other scholarships and exhibitions. For two years he was feature writer in the London office of the *Christian Science Monitor*; and contributed to the *New Statesman* and the *Westminster Gazette*. In 1923 he was sent to Spain by the *Daily News* as special correspondent. He has lectured extensively in England and the United States. His books include, *Man and His Universe*, *A Short History of Women*, *The New Age of Faith* and *Dancing Catalans*. Dr. Davies, in *Man and His Universe*, a selection of the Scientific Book Club, takes as a thesis, Science in Search of God, presenting there a balanced and skilful argument for religious truth and the God Reality as the chief objectives of mankind. The book, of course, presents other aspects of scientific enquiry.



XII

THE HISTORY OF SCIENCE A SEARCH FOR GOD¹

By JOHN LANGDON-DAVIES

THAT science is poetry is carefully concealed from the knowledge of most people by the text-books out of which science is taught in schools and colleges.

Moreover, the picture of the scientific research worker, which has been insinuated into the public mind, is largely responsible for the idea that science is poles removed from art and literature. Whereas art, literature and music are the elements of culture, science and the scientist are thought of as things apart. The people who are ashamed of being found not to have read the latest poem, seen the latest play and heard the latest violinist are not in the least ashamed of knowing no scientist since Darwin. These same people usually suppose the scientist to be devoid of human feelings; even if he does not actually leave his wife, he scarcely notices her existence; he never has a love affair; he never listens to music, nor notices that trees in autumn are beautiful; at least not if he is a *really good* scientist; then he is cold, mechanical and altogether inhuman.

And yet the truth is that the urge which makes a

¹ Taken from *Man and His Universe*, John Langdon-Davies. By permission of the author and the publishers, Harper and Brothers.

man give himself to science is precisely the same as that which produces the poet or the composer—a passion for beauty and a desire to enjoy æsthetic pleasure.

“The intense pleasure I have received from this discovery can never be told in words. I regretted no more the time wasted; I tired of no labor; I shunned no toil of reckoning, days and nights spent in calculation, until I could see whether my hypothesis would agree with the orbits of Copernicus or whether my joy was to vanish into thin air.” It is Kepler the astronomer writing, and his discovery was of certain harmonies and proportions obeyed by the planets, a poetical and musical behaviour on the part of certain stars, the next best thing to the “music of the spheres.” It so happens that Kepler was wrong, childishly wrong, we would think now, in the particular matter about which he speaks with such enthusiasm. But the episode is an example of how the chief incentive to all the earlier astronomers was to show that the stars obeyed æsthetic laws, how their motions were beautiful. Indeed beauty, nice conduct, harmonious movement, are what every scientist looks for in nature, and only when he finds them does he believe that he has found something which is true.

Since the urge to discover a scientific fact or to perfect a scientific theory is precisely the same as the urge to write a poem; and since the pleasure to be derived from understanding some one else’s theory is precisely the same as the pleasure to be derived from reading some one else’s poem, it is wrong to distinguish so vitally between science on the one hand and art on the other: both are children of the imagination, both of them ways of discovering and enjoying beauty,

both a search for the poetry lurking round the corner throughout the universe.

The fact that so many of us never discover this is due to the bad way in which science is taught in schools, and also to the general opinion among ignorant people that the object of science is utilitarian,—motor cars, gas pipes or a new patent medicine perhaps,—but if the modern man rightly understands science he will discover that it arouses in him the same exalted state of mind experienced as we listen to a beautiful piece of music, or read a sublime piece of prose. It leads him to the land beyond good and evil, where happiness and sorrow dissolve and become transformed into a mixture of reverence, awe and wistful peace.

One of the things which comes out of reading this vast epic is a realization that precisely the same forces which make you or me exalted with hope or debased with fears are working to produce curious results in the ant or the wasp; and that we, reader and writer, together with Mr. Ramsay MacDonald, Mr. Hoover, Gene Tunney and Mary Pickford, are really so many attempts to solve an unknown problem set by an unknown something; and that the ant, the tiger and the palm tree are other attempts. Human beings are not the solutions and the rest the failures; the palm tree may be as good a solution as Mr. Hoover; we do not know: all we can know is that a very exciting game is being played with ourselves as pieces, and not the least exciting thing about it is that apparently we know as much about it when we are asleep as we do when we are awake.

Let us think for a moment of our part in this enor-

mous game: this large complicated piece of machinery, our body, was not so many years ago squeezed down to the dimensions of a single cell, itself the much contracted sum total of the two machines our parents. And if we could probe backwards into times long past we should see a succession of these contractions and expansions stretching back for ever, an unbroken chain of the same individual living and reliving its life as its parents, its grandparents, its animal ancestors; after each separate cell contracting into one little cell until a time is reached when the expansions are so small that they cannot be distinguished from the contractions; until the single cell, instead of swelling into a larger being, remained a single cell always.

Reverse the process back to its true sequence in time and you have your history and mine. When we and the world of living things were young together we just broke in two and so had twins, both of our offspring being half ourselves. From that day to this the whole of our past history has consisted of an unbroken chain of individuals getting tired of life and dying; but first of all distilling into one cell all that seemed worth while of ourselves so that we might live again in our children. In this way we are our own ancestors, having passed from them through the bottle neck of the germ plasm millions and millions of times until we become ourselves, and, were it not in the process of this distilling ourselves into one cell we have always thrown out conscious memory as being of little value, we would remember what we did when we were our ancestors.

Some particularly bold scientists assert that although conscious memory was thrown out, unconscious mem-

ory persisted; and that is why a new-born baby knows how to breathe, to drink milk from its mother's breast, to digest it—because it remembers doing it before. Clearly, then, once we have a glimmering of the truth about these things, the difficulty of seeing that science is autobiography vanishes. And if science is autobiography, how much more interesting it is than we were led to expect in schools.

But we must warn the reader that it is of course only a really modern scientist who will admit this outlook even to-day, for, scientists have for a long time been terrified by the misunderstandings of the fundamentalists, mythologists, mumbo-jumbo worshippers and other half-baked thinkers into denying anything which might be construed by them into being useful for their own low purposes. These people had created out of their dogged superstitions, for all that they phrased them in words of sweetness and light, such a frightful, painful, brutal outlook on life and the universe that the nineteenth century biologists, reacting in disgust, could not admit anything into their new outlook which could be made to look as if they thought life anything but mechanical and materialistic in the old-fashioned sense of these words.

And even to this day fundamentalists force scientists in self-protection to be more old fashioned and "materialistic" than they desire to be at heart.

The whole history of science has been a direct search for God; deliberate and conscious, until well into the eighteenth century, and since then unconscious, for the most part, because so much had been discovered about God by then that scientists began to think

fit to change the name of the subject of their search. Copernicus, Kepler, Galileo, Newton, Leibnitz and the rest did not merely believe in God in an orthodox sort of way, they believed that their work told humanity more about God than had ever been known before. Their incentive in working at all was a desire to know God, and they regarded their discoveries as not only proving his existence, but as revealing more and more of his nature. If men had not wanted to know more about God, it is highly doubtful if they would have worried to know about nature. The key to the lives and labors of these men was their invariable thirst for religious truth. This was the first and greatest of the human thirsts; there were others such as the thirst for eternal life, the thirst for perfect health, the thirst for knowledge of the future and the thirst for unlimited wealth. Whatever further incentive science required beyond the thirst after God, was found in the existence of these other thirsts.

The philosopher's stone, the elixir of life, the prophetic virtues of astrology gave birth to the sciences. Although not one single human thirst has been assuaged, the gallant attempt to do so has, quite without forethought, produced a power which is able to say to men, "Whosoever drinketh of my cup shall never thirst again."

We die at seventy after much disease and long after youth has faded. We are poor and lonely and know not what is to come. But, if we can learn to understand the value of science pursued for itself alone, we can be perfectly content. Few people have been so happy as the scientists.

The history of science is the history of the most intelligent search for God, the best attempt at constructing a noble religion, which civilized men have yet known. Were that history well and fully written down we should have the modern man's Bible. Just as Joshua, Judges, Kings and Chronicles, the historical books of the Old Testament, trace the evolution of the Hebrews and of the Hebrew idea of a tribal god; so the lives and works of Copernicus, Galileo and Newton are episodes in the evolution of the modern man's God and the modern man's outlook on life. Without a clear idea of what such men have done no religious outlook to-day is really of much value.

What then, the reader may say, of the so-called conflict between science and religion? There is no such thing: there is only a conflict between two religious outlooks and two ideas of God. Copernicus, searching after God, discovered a more satisfactory idea of God than the orthodox one. And from Copernicus to the present day the whole of this conflict has been due to the irritation of orthodox religions with the new and better conceptions of the eternal truths revealed by science.

Do we mean that nature is God's created word, and the Bible God's written word, and that there is no conflict between them? Far from it: a very different God comes out of the scientific search for him from the one whom the fundamentalists have pressed flat, dry and lifeless between Genesis and Revelation. The conflict between science and fundamentalism is very real: only it began earlier than most fundamentalists realise; it began long before Darwin; before

Copernicus even. Perhaps the first fundamentalist was the early church father, Lactantius, who proved from the bible that the earth was not round. The fundamentalist idea of God was not withered by evolution, for Copernicus had killed it long before.

Indeed, to those who have read the historical books of this great Bible of science, there is very little interest to be got out of the fundamentalist God: for science, almost from its start, was able to give mankind a loftier concept to put in its place, the concept of a great artificer, a first-rate mathematician, an artist to the finger tips, instead of an irritable old gentleman believing in corporal punishment.

This bible, like the Christian one, has an old and a new testament; the old ending in gloom and the mutterings of the minor prophets like Herbert Spencer; the new at once destroying and fulfilling the old.

The history of science is, then, a poetic search for God, carried out by rummaging among man's old family records, and as such it will be sketched here. Why has so much human energy and imagination gone to the making of this search? Partly because of an honest love of adventure inherent in all energetic human beings to be satisfied by such a search to a far greater degree than by any other means. Money making, making love, sport, politics, all of them bore the truly energetic man; for even when he has squeezed them dry of interest, he will find himself with energy still unused. But all his energy is needed for the most exciting of all quests, the most exacting and exhausting of all hobbies, the search for truth.

But there is another reason besides honest love

of adventure: it is that, whether rationalists like it or not, man is a believing animal, and the really enlightened man is not the one who believes nothing, but the man who founds his belief on the firmest rock of reality. Such a man sees in the scientific picture of the universe which happens to be painted in his age the most perfect foundations for his beliefs; and to what is known he adds an overbelief, something which cannot be proved, but which, on the other hand, cannot be disproved by the body of natural knowledge on which it is built. This overbelief is a man's religion; any overbelief which can be disproved by what science can show to be true is his superstition.

A man's overbelief then depends upon his knowledge of the universe; in so far as he is ignorant about the universe, that far is his religion likely to be valueless to himself and to every one else. For the modern man to hold overbeliefs without a knowledge of the historic books of his Bible, of Copernicus, Galileo, Newton is as ridiculous as for a fundamentalist to doubt Darwin without having read Genesis.

We have got so used to the idea that our beliefs or faith consist in holding for true those things that we have neither time nor training nor courage to examine logically, that this idea of founding our overbelief, our religion, on a knowledge of the universe derived from science may seem fantastic and impossible. We haven't the time to study the universe, we may complain; and yet we want to believe. The truly great Victorian, W. K. Clifford, imagines just such a man as this: " 'But,' says one, 'I am a busy man; I have no time for the long course of study which would be necessary to make me in any degree a com-

petent judge of certain questions, or even able to understand the nature of the arguments.' *Then he should have time to believe.*" The modern man refuses to take this lazy attitude: he has his religion, his total reaction to life, his myth, but he takes every pains to see that it squares with all that science can tell him.

And why does the modern man have a religion? Because the material facts of life are not sufficient for his happiness. Nothing is more certain than that for the majority of human beings alive to-day the future holds more that is unpleasant than that is pleasant. There are disappointments, disease, loss of friends, poverty, misunderstanding, thwartings in front of all of us, and then the last enemy, death. When men were children they invented a loving father to whom they could fly as chickens to a hen, and they invented another life with all the unsatisfactory features of this one left out. Science set out to find proofs of the existence of this loving father and of the perpetual holiday after death; and it must be confessed that it has failed completely in its quest.

Now science was made for man and not man for science; and if science failed to do what was required of it, we might expect man to abandon it as good for nothing. Let it remain for mundane things, man might say; although it has not quenched our thirst with the elixir of life it has healed our diseases and made bodily life more tolerable. It has multiplied our powers and our activities and made many things easier and more comfortable. But of its chief function, that of discoverer of God, the kind father, and

of the Elysium which could alone justify him in creating us, it has proved ineffectual. Let us forget it.

Curiously enough no man who has once learned to understand science as poetry and as religion ever feels like this. For in the search he discovers unexpected prizes, undreamed-of emotional satisfactions, which compensate him for any childish dreams he has to give up.

RELIGION IN A WORLD REMADE BY
SCIENCE

HARLAN T. STETSON

HARLAN TRUE STETSON took his Ph.B from Brown University in 1908, his Sc.M. from Dartmouth in 1910, and his Ph.D. from the University of Chicago in 1915. He began his teaching experience at Dartmouth in 1908, and continued to teach at a number of colleges including a period at Harvard where he was instructor in astronomy from 1916 to 1920, and assistant professor from 1920 to 1929. In 1929 he became head of the department of astronomy at Ohio Wesleyan University, and director of the Perkins Observatory. He has accompanied eclipse expeditions to various parts of the world; and was head of the eclipse expedition to Sumatra in 1926 and to Malaya in 1929. Among his writings may be mentioned in particular a *Manual of Laboratory Astronomy*. He holds membership in several astronomical societies, and social organizations. He has specialized in a number of subjects associated with astronomical research; and in these subjects is recognized as an authority.



XIII

RELIGION IN A WORLD REMADE BY SCIENCE

By HARLAN T. STETSON

NOT long ago I was scheduled to address a gathering of business men on some recent contributions of astronomy to the modern world. Sitting at the luncheon which preceded this astronomical indulgence, I studied the various members of the group, as any speaker is wont to do in establishing a proper rapport.

The group represented all sorts of occupations, manufacturers, salesmen, doctors, lawyers, bankers, and scattered here and there as one often finds in a club group of this sort were a few distinguished ministers of the gospel.

Just opposite me sat a man in his early forties, of round face, gray hair, and black eyes, whom I took for a typical Babbitt. There was something, however, of an uncertainty in his features which made a fair estimate of his intellectual outlook somewhat problematical.

Shortly a conversation was started by the gentleman on my left making inquiry as to the relative merits of the recent theory of cosmogony just advanced by the English scientist Jeffreys, and the widely advertised cosmogony of Sir James Jeans. During the early sentences of the conversation which followed,

the gentleman opposite me exposed the fact that he too had recently read this account of Jeffreys in the press. He admitted that even this popular article was too technical for his understanding. If there was a lingering doubt that there was modesty in such a statement it was quickly dispelled when he remarked, "Anyway, I believe that the world was created in six days. Yes, six real days, such as we know them now." I confess my surprise that in a supposedly intelligent group of this sort one should find an individual on the under side of forty with so stereotyped an intellect. I wonder if, like the poor, the fundamentalists are always with us, and I have grave doubts whether or not we can do them any good.

The recent advances of modern science have gone far to make untenable the crude materialistic doctrines of a generation ago, but provide fertile soil for an intelligent religion that can give, I think, some meaning to existence in an all but infinite cosmic scheme.

When one reflects on the damages wrought by fundamentalism on the creative religious outlook, one often wonders if the problem propounded by a great religious teacher, that a man's foes shall be they of his own household, is not applicable in the religious realm.

Quite on the opposite side of the picture we meet also now as always, the self-styled free thinker, who appears to guide his intellectual process by avoidance of all recognised doctrine as though the path to creative thinking was to be obtained merely by the avoidance of all recognised intellectual hazards. Such a type of mind eagerly grasps for the latest discoveries of the scientist to capitalize a pet doctrine in mechanism, whose premise is the doctrine of chance,

and whose predetermined conclusion is that man is the unfortunate accident of a purposeless mass of cosmic machinery, momentarily caught in the maelstrom of fate.

Between these forbidding promontories of Scylla and Charybdis must the prophet of a modern religion steer his course towards an uncharted sea.

To attempt to dispel all religion from the category of human experience is to deny the element of human nature which not only makes existence tolerable, but which has stood for all which has made worthwhile some of the greatest achievements in the records of civilization. Such a statement, I think, scarcely can be challenged, provided a man allows himself a liberal interpretation of the word religion. As long as a man maintains any standards of living, holds to ideals, and indulges in Utopian dreams, he will probably be incurably religious. What sort of religion, however, suits his indulgence will depend very much I fancy, on his interpretation of the universe around us, a universe made more staggering to his imagination and increasingly intricate in its machinery by every subsequent discovery of science. In this respect, whether we will or not, a man's science becomes intimately associated with his religion.

To be sure, modern astronomy tells us that all the stars are suns and our sun but a rather insignificant star lost in a galactic system we call the Milky Way. Mankind dwells upon a tiny earth we call our world, and is being whirled about the sun with the swiftness of a projectile. The sun and all its planets rush through space 400,000,000 miles a year, across a

universe so vast that light traveling 186,000 miles a second consumes 100,000 years in making one trip. Even more remote are other universes at distances so vast that their light takes a million years to come to earth.

Mankind did not always reason thus. Once man took the sky at its face value, for what it was to him as it met his upward gaze. The azure blue of day was but a canopy of heaven supported just beyond the horizon on some mysterious pillars of the gods. The sun itself ran its daily journey from east to west, moved by the spirit of the Creator. The stars came out like street lamps lighted by the angels, to guide and guard man's ways by night.

To the ancient mind the earth was the stage on which the drama of mankind was being enacted. Thus man, occupying the center of interest, was the chief concern of creation. All else was incidental save for the mystic powers above the veil of heaven we call the sky. Hence, in the story of creation in Genesis how casual is the reference, "the stars also." If an astronomer were rewriting the account, it might read somewhat as follows: From the beginning there have been great stellar universes each so vast that light traveling at the incredible speed of 186,000 miles per second takes hundreds of thousands of years to cross it. These universes stream through space at distances so remote from one another that light takes not thousands but even millions of years to pass from one to the other, so that no matter where in such a cosmic scheme one may regard himself he can never learn the true nature of things at any one time. Even were all alike and changing together, the appearance

of them would differ vastly as light from the various sources arrives sometimes early, sometimes late. These stellar universes are composed of hundreds of millions, yes billions, of gigantic, hot, gaseous bodies—the stars. One among these systems is the galactic system, composed of a billion or more of such bodies all in rapid motion. These stars differ enormously in dimension; some are so huge we call them giant stars, others so tiny we call them dwarf stars. Among these dwarf stars is the sun. About the sun whirl little planets, the largest of which is a planet called Jupiter. There are other planets—Neptune, Uranus, Saturn, Mars, Venus, and Mercury. Then there is the earth also. On the earth, as presumably on many other bodies, arise all sorts of forms of life and among the various forms of life at length comes man, who looks into star-strewn space and wonders, as we wonder.

Apart from the direction of gravity which draws all things towards the centers of stars and planets, there is no such thing as up or down. Man looks, therefore, out into space and comes to find that he dwells among the stars—stars about him on every hand. He dwells upon a moving earth, spinning on its axis like a top, giving him a view into nearly every niche of space in the course of twenty-four hours. Again, he travels on a moving earth which whirls about the sun a turn a year, and earth and sun together pursue a flight through space of 40,000 miles an hour, 400,000,000 miles a year, while the passing stars are so far distant, they stream by so slowly, that centuries elapsed before man perceived their slightest drift.

Thus has man's view of the cosmos changed from

his little homocentric picture of creation to a scheme so vast that were it not for his own self-consciousness he might well regard himself as out of the picture.

Astronomically considered, life is but an incident in the history of a planet. Yet associated with that life in its more conscious forms is an inquiring intelligence that suggests its origin. Are we ourselves perhaps a limited expression of an all-pervading consciousness? May some spark of such consciousness exist potentially with the smallest units of matter? Electrons, identical so far as we can tell, assemble into different aggregations and produce atoms of widely differing characteristics. Atoms of various elements, in turn, combine to make molecules of substances having properties vastly different from the qualities of the elements themselves. Is it that these same units of which worlds are made are the building blocks of mind? Is the unification of all the lesser units into some super-universe the supreme order of intelligence? If this be so we are ourselves a part of such intelligence.

It is inevitable that a man's reflection on such a universe as we have pictured should react upon his life philosophy. Considering the millions of years in which man has been adapting himself biologically, the transition of his thinking in the last few centuries has been extraordinarily rapid. The demand for readjustment of ideas to keep pace with the progress of science was perhaps never more acute than now. We have seen the flat earth and its overarching sky of yesterday metamorphosed into a stellar system of such dimensions in time and space that even the astronomer

is helpless in his attempt to conceive adequately of its proportions.

One hears much these days of the lack of conflict between science and religion, that these feats of intellectual effort represent entirely distinct categories and that a conflict between true science and true religion is, therefore, quite impossible. While there may be metaphysical grounds for such conclusions, to the man of the street such sophistry may prove more confusing than helpful, supposing he is trying to build for himself some sort of a philosophy of religion which will at least be consistent with the physical universe of which he himself is a part. To be sure, there are those who have no desire or perhaps capacity to exert themselves mentally, whose religion must forever be no more than an adherence to an ecclesiastical régime, and whose science is represented by its inventions rather than by its method of thought. But to such this volume is not addressed.

One cannot survey the vast body of knowledge which is the heritage of the twentieth century without realizing the indelible imprints left by the thinking of yesterday, whether one reflects upon the field of science or upon religion. In examining the progress of scientific thought, however, one becomes aware of the characteristics of its method which marks the scientific mind *per se* more astutely alert to a changing prospective than has been wont in the category of religion. Since the principal religions of the world have grown up about certain traditions and certain personalities, holiness may have been mistaken for

reverence. Reverence for tradition is what makes fundamentalism possible in a modern epoch. Yet it is this same reverence for tradition which has bred that conservatism that recoils from the strange and the new, and has retarded to the danger point the progress of religion.

The principal religious systems to-day have come down from the age of primitive cosmology. The resulting clash of the system of thought fostered in æstheticism with the modern scientific age was inevitable, and is not inconsequential.

It is, therefore, not surprising that millions of people to-day, by nature truly religious, feel themselves near the brink of spiritual disaster in endeavoring to adapt certain religious traditions to a universe of several billion suns in which man appears to play less than a puppet's part. It is little wonder, therefore, that many intelligent minds have abandoned all attempts to reconcile any scheme of religion with the world of science. Many a creative mind would prefer to share in the fatalism of Theodore Dreiser, or the philosophy of Harry Elmer Barnes, than to indulge himself in what he regards as puerile platitudes of religion.

For the scientist who regards the universe as an expression of law and order, which in turn has alone been discoverable by virtue of mind, such an extreme position appears neither to be inevitable nor a satisfactory solution to one's intellectual dilemma. That a new religion shall be evolved, based on a reverence for the universe as is, rather than upon tradition which was, appears not only possible but probable. In attempting to follow the gleam which may lead towards such a religious experience let us examine the

assets and liabilities of the tenets of an inherited faith on the one hand, and the molding influences of science on the other.

The pragmatic value of almost every system of religion lies at least in part in the ability of the religious outlook to focus a man's attention upon forces outside of himself, and presumably beyond his control, to mold his future. Whether such influences have been for good or evil has largely been responsible for courage or fear, or for resignation in meeting the kaleidoscopic events of existence. We find, therefore, traditional religions developing certain ecclesiastical régimes designed to win the approval of a benevolent Being, on the one hand, or to appease malevolent spirits on the other. So far as religion has tended to make the most of itself through its appeal to idealism, it has been and always will be an asset in developing a satisfactory philosophy of living. So far as certain religious practices have made one introspective and superstitious the value of its psychology may be debated. It is in this respect that science has done much to orient the individual in the cosmic scheme and to dispel foreboding superstitions. Science and superstition can never dwell under the same roof, as the one is the embodiment of knowledge and the other the personification of ignorance.

It is perhaps inevitable that nearly every form of religion should center about a deified personality. It is the kind of conception of this deified personality which has characterised and distinguished the various religions of the world from the totem worship of primitive man to the great religions of the east repre-

sented by the Hebraic Yaweh, the Indic Buddah, the Moslem Allah, and the Christian God.

It is in reviewing the books of religion covering the development of a race consciousness that one finds the evolution of Deity reflecting each change of social organization in the history of civilization. In the book of the Christian religion one finds, for example, a continuous change in the tradition of God, from the anthropomorphic Elohim of Genesis through the tribal King Yaweh, to the God of spirit and paternal care as taught by Jesus. All of these conceptions, however, tended to create a self-consciousness and magnified the importance of the individual quite consistent with the primitive conception of the cosmic scheme where the universe of stars was but an incidental background for the divine drama.

It is almost pitiable that many of the doctrines of theology which made the conflict of science particularly acute were being crystallized in a mediæval epoch upon which the dawn of an era of scientific discoveries had its beginning. The uninformed fundamentalist of to-day might indeed suffer some disillusionment were he to realize that Augustine and Thomas Aquinas placed no literal interpretation upon the creation story of Genesis. The sad story of the warfare of science and religions is the more tragic when one reflects that many of the astronomical discoveries which have dispelled the anthropocentric traditions of religion were made by scholars skilled in the school of ecclesiasticism. The new era of science marking the renaissance, and which turned the world of thought topsy-turvy through the discoveries of Copernicus, Galileo, Newton and Darwin, could no more be stopped by the

denial of theologians than could the incoming tide by the gesticulations of King Canute. One's religious ideas, however, had become so entwined with a cosmology, made more sacred by Milton and Dante than by the Scriptures themselves, that for science to alter the one seemed the ruin of the other.

Inevitable changes of religious ideas, however, must ultimately come about through changes in the conception of Deity, made necessary through the scientific development of the cosmic scheme. Man, once in the center of a flat earth at the focus of divine favor, gradually gave way to man as a microscopic organism inhabiting a dust grain attached by gravitational forces to a second or a third rate sun caught in a cosmic whirl having a galactic system of such dimensions as to surpass the intellect of the profoundest thinker. No longer could Deity be conceived as the immediate progenitor of mankind, the king of a favored tribe, the worker of magic, or a sort of divine Santa Claus bestowing good gifts upon those most solicitous of his favors. Thus as science changes the conception of God, science has changed religion.

As soon as the story of creation began to be read in stars and rocks, the supposed historic accounts of creation in the sacred books came to be relegated to myths and folk-lore, calling for a revaluation in the books of religion on bases other than that of revelations. The greatest minds however, soon mastered the art of historic criticism and have done much to restore confidence in the scriptural books as records of religious experience rather than as stenographic accounts of doings of the Almighty sprung full grown

like Minerva from the head of Zeus. With such a basis for interpretation of the books of religion how much better fitted is the scholar of to-day for projecting the religion of the future than could be the religious zealot of yesterday, whose faith was limited by a blind tradition harassed by the continuous fear that doubt could damn his soul.

Freed from the religious dogma of yesterday, and yet eager for some guiding faith, one may feel for a time that science is a false Messiah offering nothing but the material for the spiritual, and hesitant lest adherence to the world of science may lead only to a new bondage. It was the Bishop of Ripon, who, not long ago in a public address, stated that he thought scientists should take a ten year holiday to allow civilization to catch up with the radical changes which they have wrought. Such a statement can result only from a complete misunderstanding of the ideals of science, and a lack of trust that an acquisition of new truths can be of increasing benefit to mankind. The last few years of scientific progress have done more to free man from the dreaded monster of a fatalistic philosophy than could have been brought about by any incantations of an ignorant religious seer. Never before has the conception of matter appeared so vaporous as now.

When we come to regard the ultimate building blocks of all material things as the electron, we have gone a long way from the materialistic conception of the nineteenth century towards a spiritual view of the universe not possible in the days of the atomic theory. Now that the conception of the electron as corpuscles composing an infinitesimal planetary system

is giving way to a series of vibrations in a hypothetical ether, we have a less satisfactory picture from the point of view of thinking in the concrete, but perhaps a more satisfactory one from the point of view of appreciation of spiritual realities. The new principle of indeterminism, first advanced by Heisenberg in 1927, has struck a note of uncertainty in our methods of divining the ultimate nature of matter, and we are beginning to realize as never before that science has its limitations. The very tools of the physicist are beginning to appear entirely too cumbersome to lay bare the innermost secrets of the electron. At best, our most exact measurements are but approximations of the more fundamental laws of science, but tentative assertions of a partial truth. We may well be proud of the achievements of science in adding to our knowledge of the universe, and yet we must bear in mind that after all science can give but a one-sided look into the sum total of human experiences which make up the events in our cosmic scheme. Accurate so far as it goes, science after all can give but a very restricted portrayal of the thing behind the representation. When the ultimate building blocks of atom are fast becoming reduced to an idea expressed only by a mathematical equation, we realize the vehicles of scientific representation are bringing us to the borderland between physics and metaphysics, and just beyond this horizon rise the provinces of philosophy and religion.

The inherent difficulties of the conception of time and space will bring any man to the borderland of his thinking ability. We may trace the life history of stars from dull-red giants to white-hot dwarfs, we may

trace the beginnings of planetary systems to condensations in the wisps of spiral whirls, but we cannot think of a time before which nothing happened nor can we think of a time beyond which something may not happen. Such are the limitations of the human mind. As to what was before matter, scientists cannot answer for the laws of science are based on weight and measurement of things. We grow continually aware of the existence of realms where our consciousness cannot follow. We can form a scientific picture of the universe only as it touches our three dimensional concept. But to be able to reason to a point where a consciousness becomes indefinite suggests that the mind of man leaps a little way from the world that is to another world not restricted by matter and the familiar dimensions. We all share in experiences not expressible in terms of the metric system. We have a sense of the world of Beauty, of motives, and of values, based on other standards than those of weight and measure. As long as man continues to have an appreciation for such qualities as make for ideals and the nobler emotional experiences he will have need of religion, and to say that science inherently conflicts with religion is to admit a complete misunderstanding of the provinces of either. It is inevitable that the facts of science will be a marked determining factor in the kind of religion which will satisfy the man of to-day, and the sooner one appreciates the methods, the motives, and the results of science, the sooner will one's religious thinking evolve a satisfactory spiritual experience not at variance with the universe around us. To abandon all cognizance of religion because of maladjustments of one's theology with science is as

foolish as to no longer recognise gravity because the gravitational concepts of Newton have been shown by Einstein to be but a specialized picture in a mathematical concept of more comprehensive proportions.

If any one is disheartened because of man's seemingly insignificant place in the universe, he may well take heart from the concepts of relativity which have shown that all dimensions are but comparative and that space and time are but convenient devices on which may be spread for our understanding a sequence of world events. If one were to seek a cheerful picture of man dimensionally that would appear to enhance his significance in the cosmic scheme one may reflect that as to size man physically occupies a place about mid-way between the electron and the solar system. I see, however, little reason for seeking such questionable consolation. The contribution of science which appears to me far more significant in encouraging a religious outlook is the fact that structurally man is made of just such stuff as stars are made from. Such a unity in his material make-up suggests a kinship that may well be paralleled in the spiritual world. Associated with the protoplasm of our bodily make-up is the ability to look into a starlit sky and to conceive an all but unending universe, a universe into which for a little while man comes to play his part, he knows not why, but how he plays, I fancy, will depend quite as much upon his religion as upon his science.

A God to-day, adequate to the needs of the scientific intelligence, will as far surpass the God of the world of primitive man as does the universe of Eddington surpass the old Babylonian cosmos. The sense

of an enlarged God to keep pace with the expanding universe of astronomy has undoubtedly proved somewhat disconcerting to the individualized conception of Deity made popular through the evangelical traditions of the church which for generations has emphasized the individualized relationship with a Heavenly Father whose solicitation for the human soul was consummated in the doctrine of the atonement. One may well ask, however, if the conception of an individual relationship of Deity is at all inconsistent with the conception of man as a unit of a greater intelligence as above depicted. Does not the newer conception of man as an element of the universe in both mind and body still make for the basis of an individualized relationship with the Deity, although one must admit on a more cosmopolitan scale than the dogmatic exclusiveness of yesterday's faith would allow?

Entertaining the question of the existence of life on other planets and in other systems of the universe than our own makes any adherence to a restricted philosophy of atonement quite untenable. Whatever one's view may be upon such items in the creed of the church as have been regarded as more or less fundamental, one must make room for a new chapter on the evolution of a religion which will be universe-wide in its scope.

As science has changed the concept of Deity, common in the sacred books and the more primitive conceptions of atonement, science has unquestionably altered one's outlook on the doctrine of immortality. The age old desire for a future existence probably has biological foundations in the defense mechanism

of the species for maintaining its being. The persistent determinism of mind, however, to think beyond the boundaries of space constitutes in itself some argument for the existence of intelligence not limited by metabolistic processes. However uncertain and illusionary may be the evidence of spiritual existence apart from conventional forms of life as we know it, there appears to be sufficient grounds for a doctrine of immortality which the scientist would prefer to conceive of as a non-temporal persistence of personality rather than a re-existence in a future time scale.

Confronted with such problems in reconstruction in theology as here suggested, one may well inquire how well or how ill the church of to-day, as the existent embodiment of organized religion, fits the picture.

The leaders of religious faith may deplore the depleted numbers of church adherents, but may well inquire into the causes and remedies of thinning congregations in church attendance. To lay the blame for such a questionable tragedy on the distracting tendencies of our complex civilization is but to dodge the issue. If individuals seeks recreation in other Sunday activities than divine worship one may feel assured that religious practices of to-day fail to meet the demand for re-creation and inspiration called for in a world remade by science.

Considering the rapid strides in scientific progress and the readaptation resulting in consequence, what serious attempt has been made by the organized church to adapt itself to the new demands placed upon it? One may well ask is there not herein a new opportunity for the leaders of our future faith to reinterpret reli-

gion in terms of the day that will satisfy the seeker for spiritual realities consistent with the achievements of science?

If one examines the conventional schedule of church worship, how far has it departed from the mediæval trappings of ecclesiasticism? One finds little grounds for criticism in the fundamental appeal to the emotions in a religious service so far as it combines the elements of music and educational discourse. The psychological basis for a spiritual appeal in the music of the masters is unquestionably sound, but is not the intellectual appeal of the words for which such music is an accompaniment of historic interest only? An hymnology based on the cosmology of Dante and the theology of the Middle Ages is not in keeping with progressive thought and can bring little intellectual satisfaction to the reader of scientific literature. Again it may be asked why must one have continually inflicted upon his intelligence the recital of the creed to which he himself can make no intellectual assent? One can find many intelligent preachers in the pulpits to-day who are seriously coping with the problems of revitalizing religion, but how at variance with the most brilliant modern discourses on religion is the mediæval setting of the conventional church service.

Why this persistence of the practice of the puritans in the program of worship which would not be tolerated in other activities of modern civilization? I cannot believe that man is less interested to-day in religion than in other emotional appeals. Perhaps a scientist may be as justly criticised for tampering with the performances of ecclesiasticism as have religious

leaders for denouncing the present-day tendencies of science. I have ventured upon this indulgence on the grounds of many questions which a scientist is asked that are distinctly in the category of religion, yet for which apparently the inquirer finds no satisfactory answers in the religious practices of the day. Only by the interchange of view-points and the intelligent comparison of its methods and problems can science and religion hope to join hands in evolving some philosophical concept big enough to embrace both God and his universe, and simple enough in its approach to truth to make a religion workable and satisfying in its expression to the modern man in an age of science.

THE UNIVERSE A GREAT THOUGHT

SIR JAMES JEANS

SIR JAMES JEANS may be numbered among adherents to the later scientific school which teaches that the universe around us is more than a mechanical structure. He refers to it as a Great Thought, the work of the Supreme Architect, the Master Mathematician. Yet he is not prepared to make definite statements as to the attributes and methods of this creative reality. He was born in London, in 1877, son of W. T. Jeans, and received his academic training at Trinity College, Cambridge, where he has been a fellow and university lecturer in mathematics. He was professor of applied mathematics in Princeton University, 1905 to 1909; and Stokes lecturer in applied mathematics in the University of Cambridge, 1910 to 1912. His publications include articles and books on mechanics, magnetism, electricity, mathematics and cosmogony. With publication of *The Universe Around Us*, in 1929; and more particularly, with *The Mysterious Universe*, in 1930, Dr. Jeans took a place in the front rank of those scientists who are applying to scientific fact metaphysical reasoning.



XIV

THE UNIVERSE A GREAT THOUGHT ¹

By SIR JAMES JEANS

OUR remote ancestors tried to interpret nature in terms of anthropomorphic concepts of their own creation, and failed. The efforts of our nearer ancestors to interpret nature on engineering lines proved equally inadequate. Nature has refused to accommodate herself to either of these man-made moulds. On the other hand, our efforts to interpret nature in the concepts of pure mathematics have, so far, proved brilliantly successful. It would now seem to be beyond dispute that in some way nature is more closely allied to the concepts of pure mathematics than to those of biology or of engineering, and even if the mathematical interpretation is only a third man-made mould, it at least fits nature incomparably better than the two previously tried.

Fifty years ago, when there was much discussion on the problem of communicating with Mars, it was desired to notify the supposed Martians that thinking beings existed on the planet earth, but the difficulty was to find a language understood by both parties. The suggestion was made that the most suitable language was that of pure mathematics; so it was proposed to light chains of bonfires in the Sahara, to

¹ From *The Mysterious Universe*, by James Jeans. By permission of the Macmillan Company, publishers.

form a diagram illustrating the famous theorem of Pythagoras, that the squares on the two smaller sides of a right-angled triangle are together equal to the square on the greatest side.

To most of the inhabitants of Mars such signals would convey no meaning; but it was argued that mathematicians on Mars, if such existed, would surely recognize them as the handiwork of mathematicians on earth. In so doing they would not be open to the reproach that they saw mathematics in everything. And so it is *mutatis mutandis* with the signals from the outer world of reality, which are the shadows on the walls of the cave in which we are imprisoned. We have already considered with disfavor the possibility of the universe having been planned by a biologist or an engineer. From the intrinsic evidence of his creation, the Great Architect of the Universe now begins to appear as a pure mathematician.

In the second place, our statement may be challenged on the ground that there is no absolutely sharp line of demarcation between pure and applied mathematics. It would of course have proved nothing, if nature had merely been found to act in accordance with the concepts of applied mathematics; these concepts were specially and deliberately designed by man to fit the workings of nature. And it may be objected that even pure mathematics does not in actual fact represent a creation of our own minds so much as an effort, based on forgotten or subconscious memories, to understand the workings of nature. If so, it is not surprising that nature should be found to work according to the laws of pure mathematics. It cannot, of course, be denied that some of the concepts

with which the pure mathematician works are taken directly from his experience of nature. An obvious instance is the concept of quantity; but this is so fundamental that it is hard to imagine any scheme of nature from which it was entirely excluded. Other concepts borrow at least something from experience; for instance multi-dimensional geometry, which clearly originated out of experience of the three dimensions of space. If, however, the more intricate concepts of pure mathematics have been transplanted from the workings of nature, they must have been buried very deep indeed in our sub-conscious minds.

This very controversial possibility is one which cannot be entirely dismissed, but in any event it can hardly be disputed that nature and our conscious mathematical minds work according to the same laws. She does not model her behaviour, so to speak, on that forced on us by our whims and passions, or on that of our muscles and joints, but on that of our thinking minds. This remains true whether our minds impress their laws on nature, or she impresses her laws on us, and provides a sufficient justification for thinking of the designer of the universe as a mathematician.

Personally I feel that this train of thought may, very tentatively, be carried a stage further, although it is difficult to express it in exact words, again because our mundane vocabulary is circumscribed by our mundane experience. The terrestrial pure mathematician does not concern himself with material substance, but with pure thought. His creations are not only created by thought but consist of thought, just as the

creations of the engineer consist of engines. And the concepts which now prove to be fundamental to our understanding of nature—a space which is finite; a space which is empty, so that one point differs from another solely in the properties of the space itself; four dimensional, and more, even seven dimensional spaces; a space which forever expands; a sequence of events which follows the laws of probability instead of the law of causation—or, alternately, a sequence of events which can only be fully and consistently described by going outside space and time. All these concepts seem to my mind to be structures of pure thought, incapable of realisation in any sense which would properly be described as material.

To these I would add other more technical concepts, typified by the “exclusion principle,” which seems to imply a sort of “action at a distance” in both space and time—as though every bit of the universe knew what other distant bits were doing, and acted accordingly. To my mind, the laws which nature obeys are less suggestive of those which a machine obeys in its motions than of those which a musician obeys in writing a fugue, or a poet in composing a sonnet. The motions of electrons and atoms do not resemble those of the parts of a locomotive so much as those of the dancers in a cotillion. And if the “true essence of substances” is for ever unknowable, it does not matter whether the cotillion is danced at a ball in real life, or on a cinematograph screen, or in a story of Boccaccio. If all this is so, then the universe can be best pictured, although still very imperfectly and inadequately, as consisting of pure thought, the

thought of what, for want of a wider word, we must describe as a mathematical thinker.

In the stately and sonorous diction of a bygone age, Bishop Berkeley summed up his philosophy in the words:

“All the choir of heaven and furniture of earth, in a word all those bodies which compose the mighty frame of the world, have not any substance without the mind. . . . So long as they are not actually perceived by me, or do not exist in my mind, or that of any other created spirit, they must either have no existence at all, or else subsist in the mind of some Eternal Spirit.”

Modern science seems to me to lead, by a very different road, to a not altogether dissimilar conclusion. Because of our different line of approach we have reached the last of the above three alternatives first; and the others appear unimportant by comparison. It does not matter whether objects “exist in my mind, or that of any other created spirit,” or not; their objectivity arises from their subsisting “in the mind of some Eternal Spirit.”

This may suggest that we are proposing to discard realism entirely, and enthrone a thoroughgoing idealism in its place. Yet this, I think, would be too crude a statement of the situation. If it is true that the “real essence of substances” is beyond our knowledge, then the line of demarcation between realism and idealism becomes very blurred indeed. It is little more than a relic of a past age in which reality was believed to be identical with mechanism. Objective realities

exist because certain things affect your consciousness and mine in the same way, but we are assuming something we have no right to assume if we label them as either "real" or "ideal." The true label is, I think, "mathematical" if we can agree that this is to connote the whole of pure thought, and not merely the studies of the professional mathematician. Such a label does not imply anything as to what things are in their ultimate essence, but merely something as to how they behave.

The label we have selected does not, of course, relegate matter into the category of hallucination or dreams. The material universe remains as substantial as ever it was; and this statement must, I think, remain true through all changes of scientific or philosophical thought.

For substantiality is a purely mental concept measuring the direct effect of objects on our sense of touch. We say that a stone or a motor-car is substantial, while an echo or a rainbow is not. This is the ordinary definition of the word, and it is a mere absurdity, a contradiction in terms, to say that stones and motor-cars can in any way become unsubstantial, or even less substantial, because we now associate them with mathematical formulæ and thoughts, or kinks in empty space, rather than with crowds or hard particles.

Dr. Johnson is reported to have expressed his opinion on Berkeley's philosophy by dashing his foot against a stone and saying: "No, Sir, I disprove it, thus!"

This little experiment had, of course, not the slightest bearing on the philosophical problem it claimed to

solve; it merely verified the substantiality of matter. And however science may progress, stones must always remain substantial bodies, just because they and their class form the standard by which we define the quality of substantiality.

It has been suggested that the lexicographer might really have disproved the Berkeleian philosophy if he had chanced to kick, not a stone but a hat in which some small boy had surreptitiously concealed a brick. As Sir Peter Chalmers Michell puts it, "the element of surprise is sufficient warrant for external reality," and "a second warrant is permanence with change—permanence in your own memory, change in externality." This, of course, merely disproves the sophist error of "all this is a creation of my own mind, and exists in no other mind." But it is hard to do anything in life which does not disprove this. The argument from surprise, and from new knowledge in general, is powerless against the concept of a universal mind of which your mind and mine, the mind which surprises and that which is surprised, are units or even excrescences. Each individual brain cell cannot be acquainted with all the thoughts which are passing through the brain as a whole.

Yet the fact that we possess no absolute extraneous standard against which to measure substantiality, does not preclude our saying that two things have the same degree, or different degrees of substantiality. If I dash my foot against a stone in my dreams, I shall probably wake up with a pain in my foot, to discover that the stone of my dreams was literally a creation of my mind and of mine alone, prompted by a nerve-impulse originating in my foot. This stone may typify

the category of hallucinations or dreams; it is clearly less substantial than that which Johnson kicked. Creations of an individual mind may reasonably be called less substantial than creations of a universal mind. The uniformity of nature proclaims the self-consistency of a universal mind. The uniformity of nature proclaims the self-consistency of this mind.

This concept of the universe as a world of pure thought throws a new light on many of the situations we have encountered in our survey of modern physics. We can now see how the ether, in which all the events of the universe take place, could reduce to a mathematical abstraction, and become as abstract and as mathematical as parallels of latitude and meridians of longitude. We can also see why energy, the fundamental entity of the universe, had again to be treated as a mathematical abstraction—the constant of integration of a differential equation.

If the universe is a universe of thought, then its creation must have been an act of thought. Indeed, the finiteness of time and space almost compel us, of themselves, to paint the creation as an act of thought; the determination of the constants such as the radius of the universe and the number of electrons it contained imply thought, whose richness is measured by the immensity of these quantities. Time and space, which form the setting for the thought, must have come into being as part of this act. Primitive cosmologies pictured a creator working in space and time, forging sun, moon and stars out of already existent raw material. Modern scientific theory compels us to think of the creator as working outside time and

space, which are parts of his creation, just as the artist is outside his canvas.

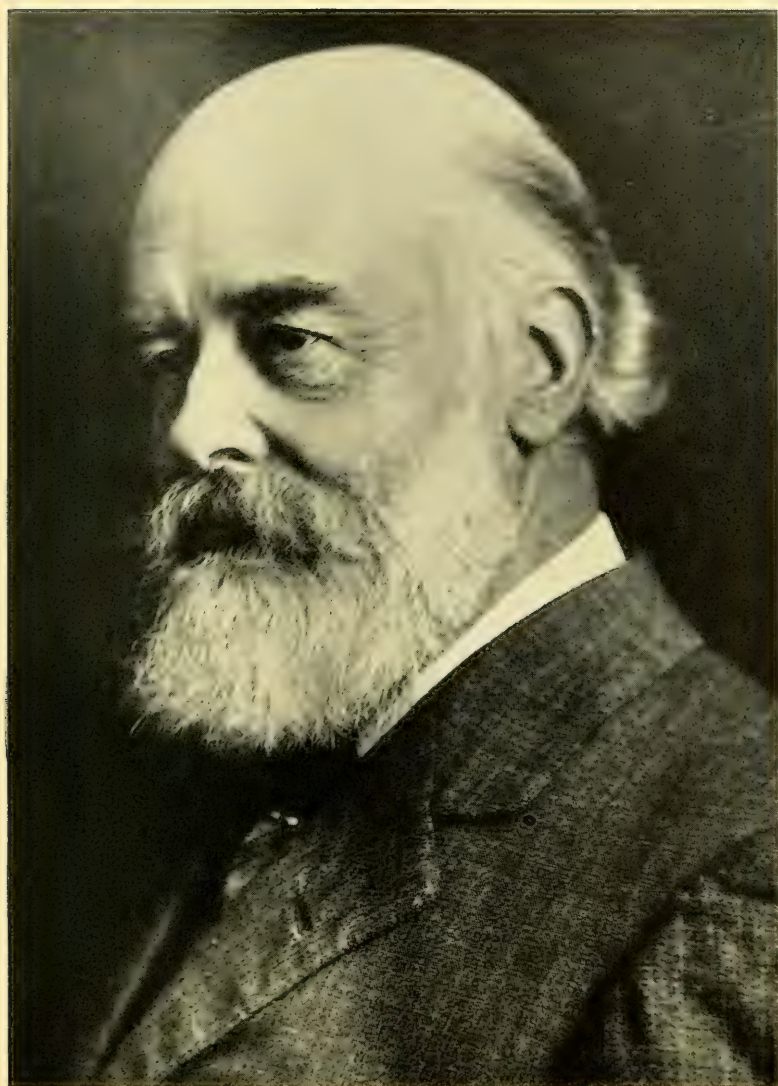
And yet, so little do we understand time that perhaps we ought to compare the whole of time to the act of creation, the materialisation of the thought.

The two papers which follow, by Sir Oliver Lodge and J. Malcolm Bird, discuss psychical research. The element they seek was called by that great English scientist Sir William Crookes, "A psychic force controlled by an intelligence unknown to science." We also remember what William E. Gladstone said of it: "Psychic Research is the most important work being done in the world to-day, by far the most important." Nor must we forget the sagacious, somewhat sardonic epigram of George Bernard Shaw: "The man who was scientific enough to see that the Holy Ghost was the most interesting of all the hard facts of life, got easily in front of the blockheads who could only sin against it."

THE SCIENTIFIC ARGUMENT FOR PER-
SONAL SURVIVAL

SIR OLIVER LODGE

SIR OLIVER LODGE, who contributes one of the most valuable papers in this symposium, was born at Penkull, Staffordshire, England, in 1851. For fifty years he has been a student and investigator of cosmic phenomena, beginning his active teaching career as Professor of Physics at University College, Liverpool, England, in 1881, and remaining there nine years. He has served as president of the Mathematical and Physical section of the British Association, president of the Physical Society of London, president of the Society for Psychical Research, and president of the British Association. In 1919 he was awarded the Albert Medal of the Royal Society of Arts as the pioneer in wireless telegraphy. His publications number upwards of thirty, and include treatises on mechanics, school reform, electrons, man and his universe, the World War, evolution and human progress. Perhaps he is more widely and popularly known, however, as one of the world's leading advocates of personal survival of death. His books on this theme: *Raymond, or Life and Death*; *Science and Immortality*; and *Why I Believe in Personal Immortality*, have established his reputation as a careful, able and thoroughly scientific investigator into psychic phenomena. His paper entitled *The Scientific Argument for Personal Survival*, which follows, is a cautious yet candid exposition of the attitude of modern research toward personal survival of death.



XV

THE SCIENTIFIC ARGUMENT FOR PERSONAL SURVIVAL

By SIR OLIVER LODGE

THE hesitating attraction which some people feel for the subject of what is sometimes called spirit communication, and the instinctive dislike or repulsion which others feel for the same subject, is partly due to the influence of surroundings, and partly to the general attitude of the community in which they live. If ever the facts became generally accepted by scientific men, the attitude of the public would be gradually changed, and religious people would without insuperable difficulty adjust their views to acceptance of phenomena generally agreed upon, as they have already done in connexion with the at first heterodox discoveries of astronomers, geologists, and biologists. But as long as scientific acceptance is limited to a comparatively few individuals here and there, the general public, if uninstructed, do well to be cautious, and to wait for a wider consensus of opinion among those presumably best qualified to judge of reality. For science is a study of reality wherever it is to be found, independent of any conclusions or consequences that may be drawn from it, and irrespective of any influence that the spread of knowledge may exert upon human life and conduct.

Assertions about supernatural or unusual phenomena

are plentiful enough; but at present there is an element of uncertainty about them which militates against their general acceptance as fact. Trustworthy and crucial evidence is difficult to obtain, and there is a natural disinclination to enter upon a course of research without some *a priori* probability that the quest would lead to something real, and not into a quagmire of popular superstition and folk-lore. Testimony about obscure mental phenomena and psycho-physical happenings has been prevalent throughout human history, and among all races of men, but the phenomena testified to are at first sight so contrary to the general trend of human experience that they are naturally looked at askance, and are not examined with the same keenness and perspicacity as have been devoted during the last century or two to what seemed to be more natural phenomena,—that is to say phenomena which can be repeated in the laboratory at will, about which some guiding theory can be formulated, and which are more harmonious with the general trend of scientific progress. It is not merely because the asserted facts are extraordinary, or because they do not appeal to the senses in the ordinary way, that they are disregarded and suspected: for many of the facts in orthodox science are of this character. The constitution of the atom, and the orbits of an electron, make no direct appeal to the senses; they have to be explored by recondite methods; yet the difficulty of a complete comprehension of them does not deter competent explorers from giving them minute and sustained attention, or from elaborating theories, which, however imperfect, are susceptible of gradual improvement, and seem to open the way to a wider truth. The super-

sensual phenomena dealt with by mathematicians are just as difficult of direct apprehension, and involve just as much speculation and hypothesis, as any of the barely credible mental phenomena which are under discussion.

The aloofness of science is not really because the phenomena are elusive and difficult of observation; rather it is because they appear to run counter to preconceptions or prejudgments, or what may be called rational prejudices, based upon a long course of study of natural phenomena, with which these asserted occurrences appear to be inconsistent; so that the testimony has to be criticised, continually suspected, and frequently discarded, because it appears to be testimony in favour of what is *a priori* impossible or absurd. The aim of science has been for the most part a study of materialistic phenomena, a study of mechanism, the mechanism whereby results are achieved, an investigation into the physical processes which go on, and which appear to be coextensive with nature. Any theory which seems to involve the action of Higher Beings, or of any unknown entity controlling and working the mechanism, is apt to be extruded or discountenanced as a relic of primitive superstition, coming down from times when such infantile explanations were prevalent; from a time when there was no adequate idea of the coherent scheme of physical processes which underlie all the at first baffling and inscrutable operations of nature.

There was a time, for instance, when the movements of the planets were attributed to psychic guidance, the action of angels or some other beings; when thunder

and lightning were the direct manifestations of the wrath of Zeus; when plague, pestilence and famine were a commentary on human sinfulness, and were stemmed, not by medical and sanitary effort, but by the erection of altars and the humble submission of sacrificial atonements. The triumph of Newton and Laplace consisted in showing that the obscure and puzzling phenomena occurring in the heavens were to be accounted for mechanically by the force of gravitation. Thus it was that modern science was born; and on those lines it has continued its successful career. Lightning became one of the inanimate manifestations of electricity: volcanoes were due to the spontaneous radioactivity of complex atoms: disease was due to the secretions of microbes and bacteria, which were visible under the microscope. And the ambition of science was to find a physical cause, on the same sort of lines, for every occurrence of whatever nature it might be. This ambition, which was formulated by Newton himself as a hope and aspiration, has been justified by long-continued experience. A physical process underlies every class of phenomenon. The evolution of living things, the evolution of the stars and planets, the birth and death of worlds, are going on before our eyes. Even the evolution of matter itself is under consideration. The stars have yielded up their secrets, the atoms also. The laws of physics and chemistry reign supreme throughout the cosmos.

What wonder then, in face of this magnificent achievement, if spiritualistic views and hypotheses are looked at askance as a backward step, a reversion to barbarism, a giving up of the clue which human genius

has found so successful; or even as treachery to the pioneers and architects who have erected the splendid structure of modern science. What wonder if the attempt is made to explain every mental process as a chemical action in the cells of the brain, to explain every action of live things as the activity of physiological mechanism, and to hold that when the physiological process is interrupted, or the machinery destroyed, all vitality necessarily ceases; in other words, that life and mind are the working of an organism, and that when the organism ceases to function, they completely perish.

And yet many biologists have themselves, when they began to philosophise, encountered a real difficulty. The mechanism was complete as far as it went: the physical processes of every action could be traced, either in fact or in imagination: but there was an outstanding difficulty about consciousness, which could not be explained by mechanism. Their own awareness of the processes going on was itself something more than the mere processes. There were things in human nature which escaped their ken, which seemed to be of a different order, something which made use of mechanism, but which transcended it, something towards which mechanical science gives no clue. The sense of beauty, for instance. What piece of mechanism could contemplate its own beauty? What mechanical device could understand its own working? How could human beings plan and contrive and design, and form theories, and seek to apprehend the universe, if they were nothing more than mechanical structures? The only way consistent with philosophic materialism was to suppose that consciousness was a

kind of illusion, and that these mysterious functions could probably be reduced to mechanism if only we had sufficient knowledge. But the formation of such a hypothesis as that is conspicuously irrational. It is leaving the safe ground of science, the exploration of reality, and denying some parts of reality itself. Such denials are illegitimate, and are themselves superstitious.

It has become pretty obvious that human nature is more than mechanism. The mechanism is at work and demands study. Physical energy and the physical and chemical processes are utilised in the working of the organism, but in every important aspect the individual transcends those processes. Even the mere sensations of colour and tone are more than belong to the physical world: physically there is nothing except vibrations of different frequency. Emotion, again, the emotion raised by poetry, drama, music, far transcends the admittedly physical basis of these things. Man plans and contrives and directs the forces of nature to higher ends: he uses and dominates the material universe: he has some understanding of it: he feels sympathy and affection: he has faith and hope and love. These elements in his nature are far more than chemical processes going on in the brain. These higher attributes are displayed and manifested by chemical processes, but in themselves they transcend and outlast them; they belong to another order of existence, interpenetrating and utilising the material, but not limited by or coextensive with it.

Well, that is the view to which some of us have been led: that is the view which most philosophers

take. Hence the *a priori* prejudgments and prejudices are now altered. If there is testimony bearing upon the perennial existence and survival of these higher things, we need no longer look at it askance, or consider it as foreign to our perception of reality. Reality is a much bigger thing than the mechanicians had thought. They are true as far as they go, but we can go much further. Testimony to survival is no longer unacceptable. Indeed we should expect something of the kind. What survival means, and what its implications are, may still remain to be ascertained. But there is a *prima facie* case for investigation. We are not traitors to science when we explore mental processes, however unusual and surprising they may be. There is a large amount of evidence that personality persists, that individuals continue after the destruction of their bodily organism. They may find it difficult to manifest their continued existence; but, according to the evidence, they have managed to do so. The evidence must be scrutinised with great care; but there is no reason to disbelieve it on *a priori* grounds. The body of evidence has grown of late years, and is growing. So that many now have no doubt that their loved ones continue, that they are still watching and helping and guiding, as of old; that realities do not go out of existence, that these higher attributes of man are just as real as any others, more real because more persistent; that there will be a time of reunion, that intelligence and character and tastes and aptitudes persist, and that love is the dominating force in the universe,—a universe far greater and higher than its merely material manifestations. It is true, as Sir Berkeley Moynihan has recently declared, that the God

of Science is a greater and more glorious Being than the God of the Theologians.

Suppose we let it be granted that accumulated evidence shows that human beings survive, a number of problems clamor for solution. What does survival mean in general? Why should it be limited to human beings? What line can be drawn differentiating one part of existence from another? It seems likely that all existence is perpetual. We certainly find that energy, for instance, continues without loss, changing form, but always constant in amount; that death is not the characteristic and fundamental thing in the universe, but continued life. Energy need not always be associated with matter; it may pass into the ether, and, indeed, is constantly so doing. Not only from every star and every fire, but from all objects without exception, there is a constant interchange of energy between ether and matter. Sometimes matter gains more than it loses, sometimes it loses more than it gains. This interchange constitutes the whole activity of what we observe; and the energy is never destroyed.

Is it the same with life? Not human life alone, but all life, animal and vegetable together? We do not know for certain, but it is a natural working hypothesis that the interaction between life and matter is temporary, while the interaction of life with the greater physical universe is permanent. In that sense survival is the law to which there need be no exception. But when we talk of human survival we mean more than that. We mean individual survival, the survival of personality and character. Now survival only applies to things which really exist. If there is no individu-

ality, then there is nothing to persist. Whether all human beings have sufficient personality to make their individual persistence likely, is a question that may be argued. Whether some of the higher animals have acquired a kind of individuality, a character and affection, which seems worthy of continued existence, may also be argued. There may be many grades of existence, many grades of personality, and accordingly there may be many grades of survival.

To illustrate this, and to get into closer touch with the subject, we may take some examples. The human body is composed of cells, and some of those cells have a life or vitality of their own. Some indeed, such as the white corpuscles in the blood, have an independent motivity, analogous to that of the *amœba*. They move with apparent spontaneity, they assimilate and digest and excrete; they subdivide and thereby increase in number: in other words, they have many of the attributes of independent existence. Yet they are essentially parts of a community: the communal life is the important thing, but by their activity they serve that communal life. They help to keep the whole body in health, and their individual life is sometimes sacrificed to that end. In so far as they are individuals, their individuality seems unimportant.

Many examples of this communal life may be adduced. For instance, in a hive of bees it would seem to be the communal life that is the important thing. The individuals go about their business in an instinctive manner, but willingly sacrifice themselves for the good of the community. Their individual existence is short and strenuous: they speedily succumb to overwork or to the dangers encountered, but the commu-

nity goes on. Moreover, it is instructive to realise that their specific activities depend not only on themselves but on their surroundings. They carry on whatever work is necessary in the particular place they find themselves. If wax is needed, they proceed to make it: if wax is provided, they proceed to shape it: if they find it already shaped, they fill it with honey. Any one bee does what is wanted at that particular place, adding to the labours of his predecessors the quota demanded. The guiding influence seems represented by a communal instinct which does not belong to the individual but to the whole community.

It appears to be much the same with the cells of the body. Where a hair is required, there it is built up by the cells which find themselves in that position: where a nerve needs renewal it is renewed. And so the parts of the body are constructed and maintained; and the waste products are cleared away automatically and instinctively, without any attention from consciousness, so long as the body is in a state of health. The cells can be diverted from their proper work by abnormal secretions and poisons, and then abnormal structures are produced, with resulting pain and perhaps death to the organism as a whole. The organism may have an individual identity, but the cells composing it apparently have not. The ingredients in food are sorted out and planted automatically in the place required by the whole organism, the identity of which does not depend on the identity of the particles, for they are in a constant state of flux.

At a lower grade we find something of the same

sort even in inorganic nature. What constitutes for instance the identity of a river, the Tiber, or the Ganges, or the Nile? We recognise that the river has a sort of identity, but it cannot depend on the particles of water which constitute it. It may be said that the identity of a river is determined by the shape and locality of the channel along which the particles move; but even that is liable to change from time to time; yet we recognise it as the same river. The river therefore has a certain individuality, displayed by the stream of particles; and occasionally it has been personified as Father Tiber, Mother Ganges, and the like. But this is obviously a poetic personification. There is no real soul or personality, or anything which calls for persistence beyond its terrestrial and temporary manifestation.

An identity of this general kind seems to belong to all vegetables and to the lower animals. There is no need to postulate permanent personal existence in their case. The question only arises when the life of an organism has reached a stage at which the elements of mind and consciousness appear, when the action becomes more than mechanical, when it shows signs, not only of accumulated memory, but of incipient reasoning power, leading to purposive action, based on accumulated or inherited experience; based not so much upon the laws of heredity alone, but upon experience acquired by the individual, so that in some sense it knows what it is doing, and spontaneously and individually tries for some end, or acts with some apprehension of the future; when it is guided, not merely by the present, but by anticipation and hope.

It is not easy to say where this element of consciousness, conscious striving for an as yet unrealised end, has begun to enter into the animal kingdom; but we see signs of it in the higher animals, at any rate in those that have become domesticated; and we are well aware of these faculties in ourselves. At some stage or other, conscious planning, or what Aristotle called "entelechy," enters into the scheme; and this element we may well call the germ of the soul. As a working hypothesis we may conjecture that where a soul exists it means the emergent evolution of something higher than ordinary life, of something which has a personal aspect, and of something which, if real, is likely to persist. If it is a very minute fragment of personality, then its survival will also be minute and fragmentary. Only when it becomes considerable and dominant will it have a considerable and dominant survival. In so far as a thing is real, it will not go out of existence; it will survive for whatever it may be worth.

Clearly there are grades of existence or grades of value; so in a sense there may be grades of survival. Surely not, it may be objected, there is either survival or there is not; there cannot be partial survival. No, but a small and trivial thing may survive in a small and trivial way. A great love endures; but a little bit of affection may still survive. The problem is one of reality. Only reality persists. But, on the other hand, all reality persists. A cloud or a crowd is dispersed and scattered and ceases to be. But that was not a reality, it was a mere aggregate of atoms or of people: when it was dispersed the individual components continue. The reality belonged, not to the assemblage, but to that which gathered them together. The emo-

tion, or the guiding principle, which assembled a conclave of Parliament or an army, may continue and may alter the course of history. A written document may have an effect long after the document has been destroyed. The soul of a poem is not in the black marks on a piece of paper; nor is its reality dependent on the physical vehicle by which it was conveyed to others. It is the soul of such things that is real, and it is that which persists.

So it may be with our bodily organism. Each organism is an assemblage of particles in a state of flux and change. The cells have a communal existence, but the permanent thing which put them together, and which by their aid has accumulated experience and developed a personal character, is not dependent on them for its identity; and it can endure long after they have been dispersed and scattered.

These being the possibilities, the remaining question is one of fact. The evidence for human survival does not depend on argument but on experience. There is a growing amount of evidence that human personality does really persist, that individual survivors have not gone out of existence. That evidence must be critically examined and subjected to scientific enquiry, and if it stands the test, it must be admitted: it must be accepted as one of the facts ascertained in the process of scientific discovery, whether we understand it or not. All that the argument has done is to show that there is nothing irrational in the idea, that we need not turn our backs on the evidence because it appears to be demonstrating something impossible. The thing is possible enough: no one has a right to say that it

is impossible. Our business is to find out what is true.

If there is trustworthy evidence tending to show that humanity has attained a grade at which a real and permanent personality has developed, then that evidence can be accepted. If the evidence goes further, and shows that some of the higher animals have reached such a grade, then that evidence can be accepted too. We have no right to draw an artificial line and say, Thus far and no further. Nor have we any right to turn down actual evidence because of our irrational and perhaps superstitious preconceptions. We have no more right to do that than we have to accept or invent faulty evidence and imaginary facts, on the ground of our preconceptions or superstitions or human longings. The emotions must be kept in their place. Things are not true because we want them to be true; but neither are they false because we feel they ought to be false. Human instincts and intuitions are not to be despised. The intuitions of genius are part of the facts, and have a weight and value of their own.

But fortunately in this vital matter we are not left to inspirations and intuitions. Cold-blooded direct evidence is vouched for, and this it is which must be examined without prejudice either way. And this it is which will ultimately convince all humanity of the truth of survival, and incidentally will in the long run enable us to realise more clearly what survival means, what physical mechanism is associated with it, what is its scope and how far it extends, and what bearing it has on the ultimate problems of reality.

PSYCHICAL RESEARCH, SCIENCE AND
RELIGION

J. MALCOLM BIRD

J. MALCOLM BIRD, psychic research expert, is probably as careful and experienced an observer of psychic phenomena as we have in the United States to-day. He is qualified from long study, experience and ability to contribute the important paper which concludes this discussion. Graduating from Columbia University in 1913 he did graduate work there in mathematics for three years, and in 1914 accepted a position there as assistant in mathematics. He went to the editorial staff of the *Scientific American* in 1916, remaining as associate editor and managing editor until 1924. He became research officer for the American Society for Psychical Research in 1925, and retained that office until 1931. From 1922 to 1924 he was secretary to the committee of Judges in the *Scientific American* investigation of psychic phenomena. His books include, *Einstein's Theories of Relativity and Gravitation*; *My Psychic Adventures*; *Margery the Medium*; *Proceedings of the A.S.P.C. for 1926, 27; and 28*. He calls the mature study he contributes to this symposium, *The Phenomena upon which Spiritualism bases its conviction of a future life, and their place in the twentieth century scientific structure*.



XVI

PSYCHICAL RESEARCH, SCIENCE AND RELIGION¹

By J. MALCOLM BIRD

PSYCHICAL RESEARCH is a term coined for application to the study of a group of phenomena that open the door to many controversies. These phenomena are of anthropological rather than cosmical content, in that their occurrence as well as their observation requires human instrumentality; and they are anthropocosmic in that they are not manifestations of the human brain and organism alone, but represent rather a reaction or relation between the human ego and the universe in which this resides.

Beyond these fearfully vague generalizations, it is not entirely clear how the field of psychical research should be defined, or where its frontiers should be drawn. The widest divergence appears on the question of bare occurrence; and when we answer this abstractly in the affirmative, as all competent and unbiased authority now does, it continues to arise over whole categories of the phenomena and over the entire phenomena of individual subjects. The phenomena by their nature in some degree require the substitution of spontaneous observation for free experiment; and the

¹ This title is used with apologies to Mr. Stanley De Brath, who employed it for a fuller discussion which he published several years ago in book form.

extent to which this is proper, the modification it should effect in scientific method and conclusion, even the question whether it does not wholly bar serious proof, remain in open controversy. Decision whether and when we should pass from mere accumulation of data to attempts at judging the significance of the data already accumulated is differently rendered according to the attitude taken on matters of occurrence and of proof. And when we do try to interpret the phenomena, we find rival hypotheses in whose behalf there exists the extreme of emotional partisanship.

Yet these phenomena have always occurred and presumably always will. It is by no means an unduly anthropocentric viewpoint to say that no picture of the universe which ignores them can be complete. Despite their present difficulties, we must do our best to deal with them.

This paper makes no attempt to deal with them in any large or general way. I seek merely to clarify a single important issue, out of the many to which the field gives rise. In doing this, I confine myself to certain of the phenomena which possess a particular common denominator, and in large measure I confine myself to that denominator. I shall start by asking the reader to accompany me into a typical séance-room; and if what I say about the proceedings here overlaps your previous knowledge, you will bear with me and appreciate that precise formulation of known fundamentals is often profitable.

This is not a commercial séance that we are to attend, though probably the medium is a professional; even a medium must eat! Every effort is made to

eliminate emotion, maintain proper procedure, and preserve the attitude of serious inquiry. The only specific move in this direction which I need mention here is the presence of a stenographer, assuring an accurate and permanent record of all that is said and done.

There will of course be more or less of darkness, of soft music, of the atmosphere of relaxation and ease. These conditions are not necessarily in conflict with the purpose of serious inquiry, and they are those best calculated to produce the fixation of sensory attention and the passivity of conscious cerebration on which hypnosis depends. The sitters ignore these conditions and are practised in ignoring them; the medium submits to them and is practised in this submission. Under their influence, he goes through a process known to him as that of entering trance. Whatever its ultimate facts, this process necessarily has its physiological and psychological sides, and on both these grounds we readily recognize it as a mere matter of auto-hypnosis. With the entranced medium this reaches a degree where the subject's normal consciousness quite evaporates, and he undergoes a definite alteration or dissociation of personality.

Thus, when the medium is "fully in trance"—when the alteration of personality is complete—there begin to function, in one way or another, personalities of quite definite character, and other than his normal self. These claim to be deceased friends of the sitters, who purport to be able thus to enter, for a time, into the medium's physical and mental organism and to use it for their own purposes. One after another these come into full apparent possession of the me-

dium's vacated shell, conversing freely with their sitters, gesturing, rising and moving about at will, playing or singing or versifying or doing anything else that is in order—behaving in all respects like substantially independent and fully developed entities.

So far as this description goes, of course, it might all be a matter of play-acting and masquerade, conscious or subconscious. But the fact that anybody takes it at all seriously suggests that there may be more to it than that. The bald facts are that in case after case, the communicators give evidence of personal identity that would be taken seriously in any court of law. Inasmuch as by the circumstances they are debarred from offering the physical evidences upon which identification ordinarily rests, it is plain that they must fall back upon the evidence afforded by their mental content. Even in strictly mundane matters, this is what a claimant does when the lapse of years has made physical identification impossible.

Now it is a fact that my mental content is unique to me. Nobody else in the world has a totality of knowledge that coincides with mine. Any other individual will know more in some directions than I do, and less in others. The personal equation will reach furthest in matters of personal past but it will be present to some degree at every point. Presumably if there were any way of controlling the data, I could identify myself absolutely by displaying my mental content. Practically it would take me too long to do this and it would be well-nigh impossible to handle the situation. For who but myself is to say just what I do and do not know? Who is to judge me if I seek to use this means of establishing my identity?

In the séance-room, of course, the situation is met by a series of compromises and approximations. When the communicator talks on a certain subject, most of what he says is known to the sitter or at least subject to check. No attempt is or can be made to exhaust his mental content, to get him to tell everything he knows. The skillful communicator seeks only to recall to the sitter *isolated trivialities*, a comparatively small number of which would be sufficient to indicate that only the person he claims to be could within any reasonable probability know them all. Practically, of course, there is extreme difficulty in establishing a really compelling presumption that the particular items which he adduces are not just those particular ones which the medium, by extensive digging and delving, has been able to learn. Practically the controlling element here is usually the approximate proof that the sitter was a complete stranger who could not have been anticipated. Practically, too, these details are for the researcher to worry about and deal with.

I may construct two fictitious but thoroughly typical examples to show how it all works. Suppose I receive a long communication in the name of Sir Arthur Conan Doyle. He reminds me of small details in our joint seances of 1923, our passage on the *Olympic*, our contacts in New York and Chicago and Toledo and Loon Lake. He speaks of a certain snapshot taken at Crowborough, showing him and his sons and myself engaged in the highly un-English pastime of one-old-cat. He mentions details of letters exchanged between himself and me, and both of us and Dr. Crandon (who like Sir Arthur enjoys the vice of exhibiting, to third

parties, his letters sent and received). All this would be exceedingly futile, and for obvious reasons.

The medium knows Sir Arthur by name and he probably knows me by sight as well as by name. Even when sitting anonymously I must always assign heavy weight to the possibility that I am recognised. Knowing us both, the facts common to us are largely public property through Sir Arthur's and my writings and through newspaper reports. In so far as they are not thus published they are at least publicly ascertainable by due inquiry. And I suppose every fake medium in the world would know my face, know whether he would exclude it if it ever appeared or whether he would admit it, and would admit it only if prepared to deal with it.

But suppose I arrange a sitting for you, incognito, and your grandfather purports to communicate. Both he and you are unknown to general fame; and there is every presumption that you yourself are quite unknown to the medium and your presence in his séance therefore quite unanticipatable. The facts common to you and your grandfather, if ascertainable at all by the medium, would be available only as the result of a long research.

Suppose, in the face of all this, your soi-disant grandfather, speaking through the medium's mouth, reminds you that he used to call you Nibs, and that your name for him was Gee-Pops. He names half a dozen of the family pets and gives details about them and indicates the order of their acquisition and loss. He reminisces about your summers together at the lodge and he gets nothing wrong. He mentions the Green Chicken and all the other sitters think he is at

a loss; but you know that he means that silly parrot which looked so much like an old hen as to have acquired this name. He refers to the lantern that got broken when you and he were lost in the fog and reminds you that it still lies in the attic behind that villainous oil likeness of his own grandfather. He laughs about the time the Widder Madden's bees swarmed on the frame of your bicycle so that you had to walk to the post office. All these details, I may say, are *bona fide* extracts from my own experience; I indulge in fiction only in bringing them all together for the single sitter and sitting. Under these circumstances, if we can be reasonably sure of your anonymity and of the medium's lack of any line on you, here is something which must be taken seriously. And whether you like it or not, it happens to be a fact that performance of this caliber is a frequent occurrence. The files of any of the Psychical Research Societies will reveal the material, and will support my statement that in seeking to display an ideal example, I manufacture one only because the actual ones are invariably too long and complicated for use in a paper of the present type.

But you must not jump at the conclusion that it was really your grandfather speaking. All you really know is that statements of fact have been made through the medium, which he could have acquired through no normal means of cognition or guessing. You may feel like asking, "If it wasn't Gee-Pops, who or what was it?" And if you do, I shall indicate what answer might be given. But we have not got to that point. For the moment, I must insist that all emphasis be given, not to the alleged identity of the communicator,

not to the fact of delivery or communication: rather merely to the presence, in the medium's mouth, of knowledge not normally his.

Before we indulge in any speculation as to how it got there, let us have a further showing of data. The séance which we have described was one of trance message, and it represents a distinct type. Another category is the clairvoyant reading. The setting is about as for the full trance performance; if there is any difference, it will lie in a less rigid enforcement of the visibly auto-hypnotic conditions. The clairvoyant passes into auto-hypnosis, but usually not of such depth or obviousness as to constitute "trance." His normal personality does not vacate; there is merely a subsidence of his conscious attention to the real physical world and to the waking mental life. This permits a hallucinatory condition in which the subject has sense impressions that are real to him but that do not correspond to any external physical stimulus. They are hallucinatory by definition, and by the same definition the condition permitting them is auto-hypnotic.

The content of these extraneous sense-impressions is exactly as though the subject were in sensory exposure to a spirit world. His state of approximation to normal consciousness enables him to report in full on what he "sees" and "hears" and "feels" and "smells" —usually while the hallucination is current, though sometimes only after it is passed. When he renders this report, the evidence that he has been in touch with your deceased friends is of precisely the same sort and power as that obtained through the trance

medium. Which is to say, his descriptions of them are correct and his accounts of what they said are factual and in character. Through him, in another way and by another operating technique than with the trance medium but none the less adequately, there has been delivered knowledge not normally his.

Now I have purposely selected extreme types of pure trance and pure clairvoyance for the preceding descriptions. Absolute purity of type however seldom occurs. Thus, in trance, there often functions a single dominating "spirit" personality who runs the seance, permitting individual communicators to speak now and again when he vacates in their behalf his position of control of the medium's organism. Often, when this is the picture, this control personality works with some of the communicators just as does the clairvoyant—describing and quoting instead of giving them access to the instrument. Equally, the clairvoyant will suffer lapses into a deeper trance, in which some "communicator" speaks directly; or he may habitually employ such full trance, reporting his visions and auditions in his own person (to report through another personality would make him a trance medium, under control) while they occur or after he awakes. Again, the trance medium will have lapses into a condition approximating consciousness and in these intervals may operate after the clairvoyant model.

It is necessary to recognize the two types, of trance message and clairvoyance. It is not necessary to regard the difference as more than a minor one of operating detail; in view of the shading between the types and the impossibility of drawing a hard-and-fast line, it is hardly even possible to do so. Both operators

give the *prima facies* of contact with a spirit world. With both, if we are to question this *prima facies*, we must give (*a*) a reason for so doing; (*b*) an alternative explanation; and (*c*) a thoroughly adequate explanation of the spirit masquerade.

We approach these matters through a type of phenomenon upon which the name psychometry has been fastened by vicious usage plus the failure of anybody to suggest another name that really "clicks." Superficially it does not look much like the mediumistic sésances which we have described. The performance centers not around a sitter at all but around a physical object. Inasmuch as success means so much more when got under conditions where there is nobody to help the medium by saying "No" or being unreceptively silent, we shall set up our hypothetical sitting after that technique. We shall suppose that you have wrapped, in such a way as completely to conceal its character, a watch that belonged to your grandfather. This you handed to me without telling me what it was or anything about it. I have taken or sent it to the psychometrist without knowing anything about it save that it comes from you. He holds it in his hands. Perhaps he stares fixedly at the package, evidently using it as an artificial aid to auto-hypnosis; perhaps he just holds it and lapses spontaneously into that slight detachment of consciousness that permits hallucination. Like the clairvoyant, he reports what he "sees" and "hears." The stenographer sets it all down, and when it is transcribed and submitted to you it comprises as good a *prima facie* case of contact with facts from the past of your grandfather (and of the

watch) as you would hope to get through direct message mediumship.

But where the message and the clairvoyant reading were got under striking *prima facies* of spirit action, there is no such *prima facies* here. Instead the *prima facies* is quite opposed to a spiritistic interpretation, which would put your grandfather in metaphorical chains to the watch, like Aladdin to the lamp. The complications that would ensue if we took several of his former possessions simultaneously to several psychometrists are only the more obvious and amusing barriers to believing this; the idea outlaws itself. The process of psychometry carries with it no spiritoid *prima facies* whatever and any attempt to inflict a spiritistic philosophy upon it is absurd.

Nevertheless, there is a large common denominator between psychometry and spirit mediumship. In both, an operator whose mental state is plainly one of auto-hypnosis and submergence of the conscious effects cognitions for which no explanation in terms of ordinary scientific dogma is available. Shall we regard this parallelism as essential; or shall we dismiss it as an incident, and fix our attention on the *prima facie* difference as the vital factor?

Scientific method has but one possible answer here. Economy of hypothesis is a scientific fetish. It is not true that two different agencies may never produce substantially identical results. It is however true that when substantially identical effects are produced, we usually find the agencies to be identical, or at worst, different aspects of a larger common cause. It is true, moreover, that no scientific mind can submit to the

parallel existence of two different causative factors leading to similar results, until every means of combining the two into a single hypothesis has been exhausted. So the requirement (*a*) above is met with the simple statement that scientific duty forces us to question the spiritoid *prima facies* of trance mediumship and clairvoyance, by making an earnest attempt to bring these under a single generalization with the psychometry that is so like them in so many other ways.

Further fortification for this viewpoint is got from a type of psychical performance which I have not yet cited. The crystal gazer, or scrier, has to have a sitter; he has also to have an object. The object bears no relation to the sitter; it is a mere crystal ball or comparable something into which the scrier stares fixedly as a means of getting sufficiently out of himself to enter the hallucinatory stage of auto-hypnosis. The things he sees in these hallucinations take usually the form of pictures in the ball; they are indifferently of spiritoid *prima facies* like the clairvoyant's visions, or of non-spiritoid aspect as when he sees the sitter alone re-enacting incidents out of his own past. Their persistent common characteristic is that they pertain to the sitter, and are true. That is, they constitute our familiar common denominator of a cognition to which the operator has no right by any normal process. Especially when allowance is made for variation in individual techniques and for the fact that numerous spiritoid mediums can actually do psychometry, it must appear that in scrying we have a true mean between psychometry and the spiritoid types, and that a dividing line will be drawn with difficulty or not at all. So

the tendency to regard their parallelisms as fundamental and their diversions as not is strengthened.

We may then fairly say that we have good reason to question the spiritoid *prima facies*. Have we anything to offer in its place? Most certainly we have. If we reason from the psychometrical *prima facies*, we can readily formulate an alternative hypothesis. We must remember that we speak in terms of broad general philosophy, disclaiming all responsibility for mechanistic details. In this sense, it is clear that what psychometry needs for its rationalization is the following picture:

We postulate a non-sensory cognition of some sort, which works as a faculty of the operator himself, in his own right. In its workings it transcends the ordinary limitations of time and space, and equally it transcends the limitations imposed upon hypothesis by the present state of scientific knowledge. The complete absence of conscious knowledge of how it works or even of conscious knowledge that it is working stamps it as a faculty of the subconscious mind-levels; which checks up prettily with the observed fact that the operator has to get more or less away from his conscious self before the faculty will work at all. Evidently the object which we present to the psychometrist serves as a sort of catalyzer or psychic link: a means whereby the psychical cognitive faculty is first put into action, and then enabled to make contact with facts pertaining to the object instead of ranging idly over the entire universe of facts external to the operator.

All this is of course pure hypothesis but it meets the demands of the situation. When phenomena occur for

which no hypothesis exists we are at liberty to coin one. Any one we coin is better than none at all; and of all those we can coin, we retain the one that seems best to serve. The present hypothesis evidently serves; and if we now carry it back to the spiritoid mediumships, it suggests another extremely pertinent analogy. Why may not the sitter for the spiritoid medium be regarded as the direct equivalent of the psychometric object: as the thing that galvanizes into action and directs the course of the operator's cognitions? Under the spiritistic interpretation he is just this; under a non-spiritistic view he remains just this.

We shall have more to say about the non-spiritistic scheme of interpretation for psychical cognitions in general which we have just advanced, and we shall have a little to add to it. For the present, even if we remain inclined to favor the spiritistic view, we must grant that we have found reasons for questioning it, and a substitute to take its place. We do not know just how effective the substitute will be when we seek to apply it to the more intensely spiritoid phenomena; we do not know how successful we shall be in meeting the third requirement, that of explaining the spiritoid *prima facies* away on a non-spiritistic basis. We turn to this question, the direct means of attack being another typical phenomenon. This time, because of the crucial character of the situation and because I have a single pertinent and brief and self-contained experience of my own that illustrates the point, I use this illustration, taking it intact just as it occurred.

The sitter was one even more demonstrably free from all possible contact with the medium than is usually the case. She did not know that the séance

was to be held, until she was invited—barely in time to get there; she did not know the time or place until brought there; she was introduced to nobody; nobody present save myself had ever seen her before.

By giving his own and her initials, a communicator (it was a routine spiritoid séance) established that he was seeking her. She asked, "Is it my father?" and he corrected her; it was her father-in-law. The sitter made no other remark to which objection could conceivably be urged. The communicator gave details of his personal appearance, including a little goatee that his friends laughed at. He told the sitter that on the preceding evening she had been at home, in her apartment, alone. Here are three independent statements; all are correct; for the first and last, as regards this sitter, a high improbability would exist. She had been washing some clothes in the bathroom basin (natural enough, once she is located at home and by herself; but why not the kitchenette?); also some funny little white things that he hadn't been able to identify (actually powder-puffs, lending extreme improbability). And as he withdrew, he said unmistakably, "Give my love to Lois," correcting a sitter who thought he had said Louis. In fact his only grandchild was of this name, Lois.

A very clean-cut, straightforward, simple, thoroughly satisfactory example of supernormal cognition, this. It is particularly good in that assuredly not all the data could have been got accidentally or obliquely from a single source; the sitter's actions of last night and the facts about the communicator are in distinct categories here. But whatever evidence the incident

affords of a valid psychical faculty, it affords none for spirit return or spirit identity; *for the communicator was alive at the time*. The sitter, not much interested, did not know this, and honestly overlooked the possibility until later; hence she was able without deceit to meet him during the séance in a natural way. Incidentally, as "spirit" communicators invariably do under any encouragement, he gave a detailed account of his "last illness."

If an isolated case, this would be interesting—and of debatable importance. One would wish to know on what basis so much could be got right, and such a vital element so completely and persistently wrong. When we learn that of all our better-grade séance-room material, a small but fairly constant percentage takes precisely this form of "communication" from a dead man who turns out not to be dead, it is evident that we have unearthed a fact of the gravest general import. What becomes of the spirit hypothesis in the presence of these "communicators" who are alive and do not know it? For this fraction of the phenomena it must be rejected. I think the well-balanced mind will reject, with it, the conventional spiritistic plea that these living communicators represent impersonation by mischievous and evil spirits. Surely this is disingenuous and silly! Impersonation is there, evidently; but, bearing in mind the non-spiritistic explanation which we have already formulated, not by spirits of any sort.

For we have seen that the supernormal cognitive faculty exercised by the psychical operator in his own right and his own person must reside in the subconscious. Now it is established that many of our dreams

represent the fabric of fiction built up by the subconscious, in its insistence upon having an explanation for some sense impression, received during sleep, and the actual source of which it is unable to observe. This gives us a picture of the subconscious as unwilling to tolerate a mystery; ingenious but not logical in its search for explanations; and possessing a high instinct for dramatization and play-acting. Picture such a fraction of the ego at a moment of psychical cognition. Here is the sitter; here are data about him which the mind must recognize as extraneous to normal modes of cognition and to anything which it is entitled to know. An explanation must be had at all costs; if none is inherent one must be improvised. Perhaps the most natural and the easiest assumption is that the person from whom the data might most readily have been got is present and gave them. In a sufficient number of cases to establish this explanation as a habit, such person will be a deceased friend of the sitter. In a sense this is preferable, since it is easier for a spiritistically inclined mind to conceive of a spirit's presence than that of a living person whose presence the senses deny. Once having invented this explanation, the subconscious will inevitably display a strong trend toward actual dramatization; and the degree to which the normal personality is submerged and the subconscious is in control will dictate whether a full speaking impersonation by the entranced medium will be staged for the benefit of the sitters, or merely a subjective impersonation in hallucinatory form to the medium himself. In the psychometrical case, the object itself suggests a vehicle for cognition other than a spirit; the data are about it and are not

usually so readily put into the mouth of a single spirit; and the subconscious is not so greatly in command so that there is less necessity felt for an explanation at all costs and less possibility of the spiritoid masquerade.

It will be noted that all this hypothesis is equally valid whether the impersonated "communicator" be actually alive or actually dead. The error of impersonating a living man as dead would occur only in those cases where the facts not cognized include the present status of this communicator. Inasmuch as the cognitive faculty does not ever make anything approaching a complete canvass of the facts pertaining to the sitter, this error would occur systematically. The theory to which its occurrence directs us is general and applies with full force to the entire body of spiritoid cognitions.

In one important sense for which I must spare a word, this theory is preferable to its spiritistic alternative. It departs less violently from existing scientific doctrine. True, it pictures a human faculty for which existing orthodox doctrine leaves no place. But the spirit hypothesis pictures a survived human personality for which existing scientific orthodoxy can find no place, for whose real existence it can find no locus and no excuse. This is much worse.

We have, then, in adequate outline, a self-consistent non-spiritistic theory under which all the cognitive phenomena of all types of mediums and psychics can be rationalized, whatever their *prima facies*. It is clear that they cannot all be rationalized under a spiritistic hypothesis; the balanced spiritist admits this to-

day, and clings to a duality of interpretation. Under this, the fraction of the phenomena which cannot conveniently be attributed to spirits at all or cannot with dignity be ascribed to spirits for whom you would wish to hold any esteem, is charged off to a non-spiritistic species of supernormal psychical cognition by the medium himself—just the thing we have been driving toward here. This is combined, by the apologetic spiritist himself, with the same notion of subconscious masquerade by the operator as a spirit that we have here set forth. Then the remaining fraction of the phenomena is reserved for the spirits, in actual truth.

This double scheme is contrary to the principle of economy of hypothesis and we cannot accept it without a lot of argument. Nevertheless it is not contrary to the whole nature of things and we must not reject it offhand. There are numerous arguments, some extremely cogent, which make it difficult to escape the conclusion that in some of our mediumistic phenomena the spirits of the dead are involved just as they claim to be. I omit these arguments here only because they are not a part of my central theme.

In common, I believe, with all other experienced psychical researchers, I am persuaded to the point of complete certainty that *if we must have a single explanation* for all the cognitive phenomena in our field, this will of necessity be a non-spiritistic one. But I am far from persuaded that we must have a single scheme. My thesis to this point is not directed against the spirit hypothesis *per se*, but merely against its universal applicability; and against the propagandist notion that it is the only theory that makes any sense or

is intrinsically worth talking about. For there can no longer be any doubt that a large percentage of the cognitive phenomena with which psychical research deals are due to a strictly personal, non-spiritistic cognitive faculty residing in the operator. Certainly we find mediums who give us the strongest grounds for suspecting that some of their communications are genuine in the spiritistic sense, and who at other times display also the non-spiritistic type of cognition. I incline to believe that we even find the two types side by side in the same séance, rather inextricably interwoven. Whatever we come to believe of the one type, the other is a phenomenon of the operator alone—and of the universe in which he lives.

This last clause is of the utmost importance, and in fact brings me to the *raison d'être* for my whole paper, and particularly for its inclusion within the present volume. Science—existing orthodox science, still of the nineteenth-century breed because the modifications which the twentieth century is effecting had not yet been assigned their definite place in the structure of orthodox science, so that it was still possible to attack these new theories under the pose of championship of orthodoxy—existing orthodox science, I say, has always turned thumbs down upon the whole field of psychical research. This was for a very good reason. The phenomena were regarded as explainable only in terms of a spiritistic hypothesis. Science had a picture of the universe, and in that picture there was no place for human survival or for a survived human. It was not merely a canonistic negation to deny these possibilities; it was an actual fact that under

the system which was supposed to rule, and for which no alternative could be conceived, these things really could not occur. That was all there was to it.

Since this pronouncement was good science, however, a lot of things have happened. Most significant of all, science has suffered a pretty fundamental overturn. Even if I had the space and the familiarity with the details to write in full about this, no convincing account could be given; for science itself does not yet know clearly just what has happened. Science does know that the old viewpoints and the old system are grossly inadequate to give a picture of the universe as it is now revealed to us, especially at the two ends of the scale, in the macrocosmic and the microcosmic aspects. Science does know approximately in what direction overhaul of the old notions must be sought. But science itself is at a loss for a system of cosmic philosophy which shall neither contradict itself nor fail to find a place for all the things that science now knows as a matter of empirical observation.

What can be stated with complete certainty is this: No longer does science maintain that all aspects of the universe must be reducible to the classical categories of matter and energy; no longer does it restrict the concept of objective reality to these categories; no longer does it draw a hard and fast dividing line between different types of reality and insist that passage from one to another is not to be contemplated. All departments of science are in accord in these ameliorations of the harsh materialistic creed of the nineteenth century. Physics and chemistry find evidence of the non-material and non-energetic categories; mathematical physics and celestial mechanics release the concept

of objective reality from its old shackles; even biology joins in by finding evidence that there is something involved in the phenomenon of life beyond matter and energy. And by way of indicating the extent to which the newer thought varies from the old, no scientist who has grasped the new principles would to-day assert, as any nineteenth-century exponent of orthodoxy would have, that action at a distance is unthinkable through any other means than energy transmission across space.

Some of my readers will recognize in these remarks the reflections of the relativistic philosophy sponsored by Einstein and those on whose work his is based; but it will also be realized that the statements of the preceding paragraph require a wider base than that furnished them by the relativistic doctrine. In point of fact, the particular service of relativity is that it provides a conceptual framework in terms of which it becomes possible to think of the new universe which the new science demands. The demand itself, however, and many of the details of the philosophy that will finally meet it, arise out of pure physical experiment, out of concrete discoveries that the real phenomena of the universe will not be contained within the classical philosophy as it had been supposed they would. In the absence of the relativity theories we should still need a new universe, but we should be vastly more baffled where to look for it.

Experimental science cries out for a new cosmic philosophy, complaining that the old one is bankrupt. Relativity offers to meet the demand. It is more than mere coincidence that psychical research steps in here, presenting a wide phenomenology, a complete hy-

pothesis covering this so far as broad philosophical outlines are concerned, and the strong suggestion that if science will but examine the matter, both the phenomena and the philosophy covering them will be found precisely in line with the new ideas toward which science is verging. The more closely we scrutinize this correspondence the more must we become convinced that it is a significant one; that the phenomena of psychical research, when rationalized as a matter of non-mediumistic cognition by the operator, are truly phenomena of the new universe that science is discovering; that when this universe has been more fully drawn in, we shall have at least a beginning of the mechanistic explanation for our supernormal cognitions which has been so conspicuously lacking in what I have said to this point.

One or two important angles have not been touched. The relativistic philosophy presents *time* in a new light, and pictures the future as having a real existence in some part co-extensive with the present. If we are to take this seriously as corresponding to reality, we must anticipate that any cognitive process which operates in the relativistic milieu will to some degree project itself into the future and bring back observations thereof. Psychical research responds at once, meeting this demand. Every branch of psychical cognition includes brilliant examples of reading of the future, inexplicable on any other basis than a relativistic one, and on precisely the scale which relativity would lead us to expect.

Again: psychology recognizes subnormal and hyper-normal subjects. These it does not characterize as

abnormal. Abnormality will be severely defined in accordance with the following argument: Paderewski, brilliant example of musical genius, is hypernormal but not abnormal. The abnormal person, in the musical sense, is the one who has music left out of his make-up; who, if you strike the note C, then G, cannot recognize that there is a difference in pitch. On this basis, we cannot regard the possessor of psychical cognitive faculties as abnormal; he can only be looked upon as hypernormal, as possessing something which in some degree we all possess. In him the faculty is exaggerated and in most of us it is so minimized as to rise to the surface—we may not say never, we must content ourselves with saying seldom. If this viewpoint is not valid, psychology is reduced to confusion; if it is valid, the cognitions which are made by psychically gifted persons more or less as a matter of routine, should occur spontaneously, every once in a great while, through normal persons. Psychical research presents a variety of evidence indicating that they do just this; that even when awake many of us are occasionally susceptible to psychic cognition, and that when we are asleep, with consciousness suspended and the subconscious holding the gate, in the closest approach to auto-hypnosis and submergence of personality that a normal person normally attains, we are particularly liable to a considerable concentration of psychical cognitions, particularly of the future.

I think it rather probable that ultimately we shall decide that some of the phenomena of psychical research are best covered by a spiritistic hypothesis, which must then subsist side-by-side with the psychological one to which I have given most of my space.

If so, then we shall have to have a philosophy of biological life which gives the human animal something to survive with, a universe which gives us a place to survive into, and a covering of cosmic philosophy that recognizes all this as an aspect of reality. If the necessity arises it will be met, and in that event we shall be able in obvious truth to say that science and religion have come together.

But failing this extreme, it remains true that science and religion are coming together and that their meeting ground to a large degree is that supplied by psychical research. Such a rapprochement calls for a contribution by both sides. Religion must contribute by losing some of its extremes of doctrinarianism. Science's contribution must consist mainly in a recession from the hard-boiled materialistic shell into which nineteenth-century science crept and in which it imprisoned itself. I know nothing which gives a stronger impetus toward such recession than the phenomena of psychical research, the non-spiritistic explanation for these which I have outlined, and the degree to which this falls in step with the trend of thought in other fields of science. The relativistic philosophy arose in the first instance as a pure mathematical exercise; the break-down of hard-boiled materialism began in the attempt to explain certain anomalous experiments in physics and chemistry and biology. Psychical research and its phenomena however at the moment represent the largest and most fruitful field for the exploitation of the newer philosophies. Through the circumstance that it has up to this moment gone its way largely without official scientific recognition, psychical research has as yet made hardly any of what a historian would

recognize as actual contribution toward breaking down the materialistic shell or toward the actual reconciliation between science and religion. But its phenomena and their philosophy stand exactly at the crossroads where science and religion must meet, and they are completely symptomatic of the relativistic and non-materialistic universe in which that crossroads must lie.

CONCLUSION

WHATEVER ideas readers of the foregoing opinions may have formed, they will conclude that the quests of the writers for truth, if not for the Absolute, were worthwhile ones; and that, though they may have differed on incidentals they agreed with striking consistency on the essentials.

Science does not make conclusive statements, though in view of its methods, apparatus and mental equipment it is as well or better qualified to speak with authority than religion. That it does not do so is the result of habits of caution long since formed. The mills of research grind slowly, but perhaps in the end they turn out better grist. In other words, while many people accept the statements of religion with mental reservations, they place no such restrictions on the conclusions of science. When science says, if it ever does, that it has found Ultimate Reality, people will believe it, just as they believe the scientific interpretation of planetary motion, and of the composition of the sun.

In brief, orthodox religion does not and cannot speak with authority, though it continues, despite a failing influence, to make *ex-cathedra* claims. It cannot present that sort of proof which thoughtful persons to-day require.

We can only repeat what we said in the Introduction, and which following statements sustained, namely, that religion's chief business is development of character, a human duty than which there is no greater.

Discovery and estimate of Cosmic Purpose—call it God if you wish—is peculiarly the task of science. Every one of us, of course, should seek after God if “haply we might find Him.” That is a necessary spiritual exercise for every man every day. But no religious creed has the shadow of a right to impose on us a formula for that search. We think men of science from Copernicus, Galileo, Newton, Faraday and on down the list of great minds and souls, have realized this truth more or less clearly. But, true to their calling, perhaps their prejudices, they have not felt qualified to undertake the quest of the First Cause, leaving the quest, too often with tongue in cheek, to religion. Contemporary science, as the foregoing has revealed, is not sure that that attitude was either fair or justified.

And surely the attitude of research is rapidly changing in that particular. The day is coming when research will learn that it is not only responsible for discovery of a fact, but for explanation of the origin and reason for that fact. Scientific opinion has travailed until now; and is bringing forth one of the finest, noblest forms of life ever conceived. Not in the history of human thinking have we been so near sight and touch of Eternal Realities: They seem all but breaking on us in aspects of grandeur and beneficence.

The conclusion of some of the best scientific minds civilization has produced, as stated in this discussion, proving that we are not living in a mechanistic dispensation, but in a universe of order and design responding perfectly to the nicety of mathematical law, and of beneficent purpose also, is not only *one* of the most important facts that confronts us—it is *the* most important. It may be the human appeal of Huxley,

the mysticism of Eddington, the reverence of Mather, the convictions of Millikan, or the simple faith of Einstein. Whatever its form it is sending men's minds rapidly forward to belief in the "vision splendid," to reverence before the splendor of Eternal Reality. And all this may be a prelude to one of the most productive, noblest ages humanity has yet known. Nor are we to forget that religion laid the groundwork in faith and inspiration.

Men need to be convinced of the reality of God. They need conclusive proof that when the pulse stops and respiration ceases that does not mean a stopping of personality. Men who do not believe these things are in distress, of course; because all the ills flesh is heir to are without explanation. The result is rebellion and desperation; and justifiably so, unless one can look with confidence beyond this three-dimensional experience, where reactionary theological dogmas, and dogmas of the cynics too, would confine us.

Scientific discovery and application is reconstructing the world. Research always has had a determining effect on religion; but in no time as at the present time. It is true, as many men of science declare, that physical science cannot prove the distinctive beliefs of religion. In no part of this book has the position been taken that they could, assuming that these distinctive beliefs are the principles announced by the Beatitudes and the Sermon on the Mount, and the wisdom of Buddha also. But science may, and probably is, proving a cosmic consciousness, and demonstrating survival of personality. The only thing you need to understand is our distinction between the function of science and the function of religion.

Scientific theory is giving us a plausible idea of a universal mind, something religion has not given us. Research, in the last few years, has conferred on religion a dignity, a richness, an expanse it never had before. For those religionists who have ears to hear and minds to comprehend, these new discoveries will touch their faith with an unexampled sublimity. Together; science with its knowledge, philosophy with its interpretation, and religion with its faith, may prove that, after all, eternal purpose is eternal goodness.

We are closer to the First Cause, and the purpose back of creation, than we ever have been. The door is ajar. It will swing back when all of us, philosophers, scientists and religionists, submerge our prejudices in a universal desire to know the truth.

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